

SOAH DOCKET NO. 582-07-2673
TCEQ DOCKET NO. 2007-0204-WDW
APPLICATION OF TEXCOM GULF) STATE OFFICE OF
DISPOSAL, LLC, FOR TEXAS)
COMMISSION ON ENVIRONMENTAL)
QUALITY UNDERGROUND INJECTION)
CONTROL PERMIT NOS. WDW410,)
WDW411, WDW412 AND WDW413) ADMINISTRATIVE HEARINGS

SOAH DOCKET NO. 582-07-2674
TCEQ DOCKET NO. 2007-0362-IHW
APPLICATION OF TEXCOM GULF) STATE OFFICE OF
DISPOSAL, LLC, FOR TEXAS)
COMMISSION ON ENVIRONMENTAL)
QUALITY INDUSTRIAL SOLID)
WASTE PERMIT NO. 87758) ADMINISTRATIVE HEARINGS

REMANDED HEARING ON THE MERITS
THURSDAY, JUNE 17, 2010

BE IT REMEMBERED THAT at 9:04 a.m., on
Thursday, the 17th day of June 2010, the above-entitled
matter came on for hearing at the State Office of
Administrative Hearings, William P. Clements, Jr.,
Building, 300 West 15th Street, Room 404, Austin, Texas,
before THOMAS H. WALSTON AND CATHERINE C. EGAN,
ADMINISTRATIVE LAW JUDGES, and the following proceedings
were reported by Lorrie A. Schnoor and Leanna Lynch,
Certified Shorthand Reporters of:

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Pages 333 - 562

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334	<p style="text-align: center;">P R O C E E D I N G S</p> <p style="text-align: center;">THURSDAY, JUNE 17, 2010</p> <p style="text-align: center;">(9:04 a.m.)</p> <p>JUDGE WALSTON: We'll go back on the record. This is a resumption of the hearing on the merits, and SOAH Docket Nos. 582-07-2673 and 2674, concerning the applications of TexCom Gulf Disposal. Mr. Greg Casey is still on the witness stand.</p> <p>And I remind you that you remain under oath.</p> <p>WITNESS CASEY: Yes, sir.</p> <p>JUDGE WALSTON: And we've progressed to cross-examination by the aligned protestants. So, Mr. Walker, you can proceed.</p> <p>MR. WALKER: Thank you, Your Honor.</p> <p style="text-align: center;">PRESENTATION ON BEHALF OF</p> <p style="text-align: center;">TEXCOM GULF DISPOSAL, LLC (CONTINUED)</p> <p style="text-align: center;">GREG CASEY,</p> <p>having been previously duly sworn, continued to testify as follows:</p> <p style="text-align: center;">CROSS-EXAMINATION</p> <p>BY MR. WALKER:</p> <p>Q Mr. Casey, good morning.</p> <p>A Good morning.</p> <p>Q If I may, let me direct your attention to just</p>	336	<p>1 the possibility of TexCom soliciting business from major generators of Class I waste in Montgomery County?</p> <p>A Yes. I remember him mentioning that, yes, sir.</p> <p>Q Okay. Given what we've just covered and the apparent notion that TexCom would want to operate as much as possible, would you agree with me that as a business model and for good business sense, that TexCom would solicit waste from whatever source -- Class I waste from whatever source they could solicit it from in order to operate as long as they could and as much as they could to make a profit?</p> <p>A Well, I don't know exactly what TexCom business model is. I have not reviewed their business plans.</p> <p>Q I understand that, and pardon me for using that phrase.</p> <p>But does it make sense to you that TexCom would want to operate as much as possible to inject as much waste as possible? I mean, that's what they're going to be in business for if they get their permit.</p> <p>Isn't that right?</p> <p>A Yes, sir.</p> <p>Q Let me ask you if in your knowledge of facilities such as the one that you're consulting here with, Class I injection facilities, if waste is not piped to the facility, what is the typical usual method</p>
335	<p>a bit of your testimony yesterday, and let me ask you if you recall being asked whether or not you've ever seen UIC injection facilities that operated 24 hours a day, 7 days a week?</p> <p>A Yes, sir.</p> <p>Q And as I recall, your response was that, yes, you had, 7 days a week, 24 hours a day?</p> <p>A Yes, sir.</p> <p>Q All right. Subsequent to that, you were asked if you had any reason to believe if the TexCom facility was going to operate at that rate, and let me remind you, if I may, that I believe your response was that "I know they would love to in order to make that much money." Do you recall that testimony?</p> <p>A Yes, sir.</p> <p>Q All right. Would you agree with me, Mr. Casey, that if TexCom receives their permit, they would, along that train of thought, want to operate as many hours as they could and receive as much waste for injection as they could?</p> <p>A Yes, sir.</p> <p>Q Now Mr. Bost, in his testimony -- were you present when he testified?</p> <p>A Yes, sir, I was.</p> <p>Q Do you recall that he testified at length of</p>	337	<p>that waste is delivered to a facility for injection?</p> <p>A It comes by transport truck.</p> <p>Q All right, sir. Would you agree with me, then, Mr. Casey, that TexCom, in soliciting business and in attempting to operate as effectively and as many hours as possible to inject as much waste as possible, if their clients do not have a pipeline to the facility, will be soliciting business that trucks the waste to their facility?</p> <p>A Yes, sir.</p> <p>Q Let me change gears just a moment, Mr. Casey, and ask you if you know, in your professional experience, what is meant by a unitized oil field?</p> <p>A Yes, sir.</p> <p>Q Would you just briefly -- I don't think we need a lesson in petroleum engineering, but just briefly tell us what a unitized field is.</p> <p>A I don't know the official, you know, designation of what it -- you know, what you would call a unitized field, but the basic premise is that you unitize the producing formation to allow, you know, all the property owners, mineral right owners within the field to basically, you know, own their percentage of oil based on their percentage ownership of the entire area. It's usually done either required by the state or</p>

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338	<p>1 asked for by an operator in order to maximize the</p> <p>2 production from the field to keep one operator from</p> <p>3 producing at a higher rate which could in turn cause oil</p> <p>4 to be left in the formation.</p> <p>5 Q All right. Are you familiar with any -- let's</p> <p>6 call them -- this is my term and it may not be correct.</p> <p>7 But are you familiar with any requirements, perhaps</p> <p>8 technical requirements, if an application is made to</p> <p>9 unitize a field?</p> <p>10 A I'm not sure what, you know -- what exactly</p> <p>11 they would require for that. I have not actually done a</p> <p>12 unitization agreement, so --</p> <p>13 Q All right. Well, let me ask you this: Do you</p> <p>14 know if the Conroe oil field is presently a unitized</p> <p>15 field?</p> <p>16 A The best of my recollection, it is a unitized</p> <p>17 field.</p> <p>18 Q All right. And do you know when that</p> <p>19 designation came about, if you know, more or less?</p> <p>20 A I don't know exactly when. I believe it was</p> <p>21 sometime in the '70s, but I'm not sure.</p> <p>22 Q Okay. Would you -- without being specific,</p> <p>23 would you agree that probably sometime in the, perhaps,</p> <p>24 early to mid '70s that occurred?</p> <p>25 A That could be correct. I'm really not sure.</p>	340	<p>1 Vic McWherter. I'm sitting here for Scott Humphrey</p> <p>2 today, who could not be here. I have no questions at</p> <p>3 this time.</p> <p>4 JUDGE WALSTON: All right. Executive</p> <p>5 Director?</p> <p>6 MS. GOSS: Executive Director passes the</p> <p>7 witness.</p> <p>8 JUDGE WALSTON: Okay. Redirect?</p> <p>9 MR. RILEY: Yes, sir. Thank you.</p> <p>10 REDIRECT EXAMINATION</p> <p>11 BY MR. RILEY:</p> <p>12 Q Let's pick up just for a moment where</p> <p>13 Mr. Walker left off, Mr. Casey.</p> <p>14 Distinguish, if you can, the terms</p> <p>15 "injection zone" and "injection interval."</p> <p>16 A The injection zone is the -- I guess the entire</p> <p>17 area of the permit which -- you know, which would</p> <p>18 include all the various sands up until the base of the</p> <p>19 confining unit, should that, you know -- and then the</p> <p>20 injection interval is the actual portion of the</p> <p>21 reservoir where the injection will take place.</p> <p>22 Q Is there -- so is the injection interval</p> <p>23 contemplated in the proposed permit in this case?</p> <p>24 A Yes. In the permit, we specified the injection</p> <p>25 interval will be in the lower Cockfield.</p>
339	<p>1 Q Okay. Do you know, Mr. Casey, if the upper and</p> <p>2 middle Cockfield Formations in the Conroe field are part</p> <p>3 of the unitized field?</p> <p>4 A I know the upper is and I think it extends to</p> <p>5 into the very top of the middle Cockfield.</p> <p>6 Q All right. With respect to the upper, middle,</p> <p>7 and lower Cockfield Formations, does the TexCom</p> <p>8 application include those three formations in its</p> <p>9 perspective injection interval?</p> <p>10 A No, sir, not in the injection interval.</p> <p>11 Q Okay. Perhaps I've used the wrong term.</p> <p>12 Would the correct term be "injection</p> <p>13 zone"? Does the application, at least prospectively,</p> <p>14 allow TexCom to inject waste in its injection zone which</p> <p>15 would include all three formations?</p> <p>16 A Yes. The injection zone as identified in the</p> <p>17 application includes all parts of the Cockfield</p> <p>18 Formation.</p> <p>19 Q Very good. Upper, lower, and middle?</p> <p>20 A Yes, sir.</p> <p>21 MR. WALKER: Your Honor, I will pass the</p> <p>22 witness.</p> <p>23 JUDGE WALSTON: Okay. Public interest</p> <p>24 counsel, and would you announce your appearance, please?</p> <p>25 MR. McWHERTER: Yes. Good morning. I'm</p>	341	<p>1 Q All right. And is that a limitation, then, on</p> <p>2 TexCom's operations? In other words, are they limited</p> <p>3 to that zone -- excuse me. Bad choice of words.</p> <p>4 Are they limited to the lower Cockfield as</p> <p>5 a place for injection?</p> <p>6 A Yes. In order for -- if TexCom wanted to</p> <p>7 inject outside of the lower Cockfield, they would have</p> <p>8 to ask for a permit modification with the TCEQ.</p> <p>9 Q Let's change gears a minute. Mr. Lee is going</p> <p>10 to bring you a document from the earlier hearing, and --</p> <p>11 just take a second.</p> <p>12 A Okay.</p> <p>13 JUDGE WALSTON: While Mr. Lee does that,</p> <p>14 can I get somebody to close the door? Apparently, we</p> <p>15 left the door open back there. Thank you.</p> <p>16 Q (BY MR. RILEY) Mr. Casey, could you explain to</p> <p>17 the administrative law judges what you have before you?</p> <p>18 A It's the permeability versus porosity graph</p> <p>19 from the OMNI core report.</p> <p>20 Q Is this the graph that Ms. Mendoza was asking</p> <p>21 you some questions about yesterday?</p> <p>22 A Yes, sir, it is.</p> <p>23 Q Could you give an identifier for the benefit of</p> <p>24 the rest of the parties? What page is indicated in the</p> <p>25 bottom right-hand corner?</p>

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342	<p>1 A It's Page 144 of TexCom Exhibit 11.</p> <p>2 Q Did I understand correctly that this is not</p> <p>3 something you or your group prepared, this graph?</p> <p>4 A That's correct.</p> <p>5 Q And tell the administrative law judges what</p> <p>6 it -- what it represents, what it purports to represent.</p> <p>7 A Well, it's a plot of the porosity and</p> <p>8 permeability numbers generated through the core analysis</p> <p>9 of the five samples that Omni labs did when they did the</p> <p>10 permeability to air measurements.</p> <p>11 Q So permeability to air measurements, you're</p> <p>12 going to have to explain that to us as well.</p> <p>13 A Basically, what Omni did is they took their</p> <p>14 samples from the five places in the core -- within the,</p> <p>15 what is it, 14 feet or so of core they had, they took</p> <p>16 five samples from the core, and they subjected that</p> <p>17 sample of the core to -- basically, they try to flow air</p> <p>18 through it. And within their equipment, they're able to</p> <p>19 measure the permeability and porosity.</p> <p>20 Q Do they have the results -- are the results of</p> <p>21 the testing you just described in that document?</p> <p>22 A Yes. The air permeability numbers are on</p> <p>23 Page 146.</p> <p>24 Q Still TexCom Exhibit 11?</p> <p>25 A Still Tex -- yes, TexCom Exhibit 11, Page 146.</p>	344	<p>1 was taken from a shale section of the core. It, you</p> <p>2 know, has very low permeability which would indicate</p> <p>3 that it's shale and not -- you know, predominantly shale</p> <p>4 and not sandstone.</p> <p>5 Q The plot on Page 144, did it eliminate the 7.6</p> <p>6 millidarcy sample?</p> <p>7 A No, it did not.</p> <p>8 Q So is it correct to say that the line drawn,</p> <p>9 based on those data points, contemplates or at least</p> <p>10 imagines the fifth sample, the outlier sample?</p> <p>11 A Yes. It includes the -- what I would consider</p> <p>12 a shale sample in the analysis to draw the line.</p> <p>13 Q Would you have included that data point in</p> <p>14 drawing the line on Page 144?</p> <p>15 A No. If I was doing this plot, I would have</p> <p>16 dropped that sample out because it isn't within the --</p> <p>17 what would be included in an injection portion of the</p> <p>18 reservoir because being shale, it's -- you know, it's</p> <p>19 not going to accept water like the higher permeability</p> <p>20 sand would. So you drop that out, and you would redraw</p> <p>21 the line just using the four samples.</p> <p>22 Q In addition to air permeability testing, was</p> <p>23 there testing using liquid done by Omni?</p> <p>24 A Yes, there was.</p> <p>25 Q Could you explain to the judges where that is</p>
343	<p>1 Q Could you read the -- I'm sorry. Is it</p> <p>2 described as in millidarcies, the air permeability of</p> <p>3 the five samples?</p> <p>4 A Yes, it is.</p> <p>5 Q And what are the values reported in TexCom</p> <p>6 Exhibit 11, Page 146?</p> <p>7 A For Sample No. 1, the permeability is 518</p> <p>8 millidarcies; for Sample 2, it's 882 millidarcies; for</p> <p>9 Sample 3, it's 545 millidarcies; for Sample 4, it's 131</p> <p>10 millidarcies; and for Sample 5, it's 7.63 millidarcies.</p> <p>11 JUDGE EGAN: All right. Could you go back</p> <p>12 through the last three because --</p> <p>13 WITNESS CASEY: Oh, sorry.</p> <p>14 JUDGE EGAN: You went a little fast.</p> <p>15 WITNESS CASEY: Sample No. 3 is 545.</p> <p>16 Sample No. 4 is 131.</p> <p>17 JUDGE EGAN: Okay.</p> <p>18 WITNESS CASEY: And Sample No. 5 is 7.63.</p> <p>19 Q (BY MR. RILEY) Of the numbers you've just</p> <p>20 reported, one that seems to be a bit of an outlier is</p> <p>21 the last one, Sample 5.</p> <p>22 A That's correct.</p> <p>23 Q Could you explain to the ALJs what your belief</p> <p>24 is regarding that sample?</p> <p>25 A The fifth sample, you know, it appears to be it</p>	345	<p>1 found, first? Where would one look in the record for</p> <p>2 the liquid permeability testing done by Omni?</p> <p>3 A The liquid permeability testing starts on</p> <p>4 Page 150 of TexCom Exhibit 11 and goes through Page 159</p> <p>5 of TexCom Exhibit 11.</p> <p>6 Q Are the results reported by Omni in the table</p> <p>7 we were discussing, on Page 146 --</p> <p>8 A No.</p> <p>9 Q -- for liquid testing?</p> <p>10 A No. That -- they were not included in the</p> <p>11 chart.</p> <p>12 Q Could you tell us what the liquid testing</p> <p>13 results reveal, in your opinion, regarding permeability</p> <p>14 of the tested sections?</p> <p>15 A In looking at the apparent -- within the</p> <p>16 analysis that Omni did, what they did is they subjected</p> <p>17 those same core samples to various types of liquid.</p> <p>18 They used a formation brine, a process water with PH of</p> <p>19 8, a process water with pH of 4. And then after the two</p> <p>20 process water samples, they reran with formation water</p> <p>21 to see if there was any change in the permeability.</p> <p>22 Q Before I get to the results, I think you said</p> <p>23 that they tested the same core samples that you just</p> <p>24 talked about on -- for air permeability. Did they test</p> <p>25 all of the core samples for liquid permeability?</p>

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346	<p>1 A No. They only tested the first four samples</p> <p>2 with the -- they didn't include the fifth sample that</p> <p>3 was predominantly shale, the low -- that showed low</p> <p>4 perm. They didn't include it in the water testing.</p> <p>5 Q So they dropped out the fifth sample from</p> <p>6 liquid testing. Is that true?</p> <p>7 A That's apparent, yes, sir.</p> <p>8 Q Can you tell us what, in your opinion, the</p> <p>9 liquid sampling test revealed regarding permeability of</p> <p>10 the four samples that you've just described?</p> <p>11 A The permeability to liquid and in the samples</p> <p>12 tended to be similar or higher than the permeability to</p> <p>13 air numbers for each sample. The permeability, you</p> <p>14 know, varied a little bit with the different waters, but</p> <p>15 it would stay in the -- you know, in the basic range for</p> <p>16 that sample.</p> <p>17 Q And what was that range?</p> <p>18 A For sample -- let's make sure I'm on the right</p> <p>19 sample number here.</p> <p>20 Q And give us a page number, if you're able to.</p> <p>21 A Okay. Starting on Page 150 of Exhibit 11.</p> <p>22 Sample No. 1A, which it appears -- you</p> <p>23 know, not having done the analysis, it appears that they</p> <p>24 took another sample of the core adjacent to where they</p> <p>25 took the sample for the air permeability measurement</p>	348	<p>1 Q And was that true of Sample 1A, as well, or is</p> <p>2 that -- was it done differently?</p> <p>3 A Let's see. Sample -- and let me correct.</p> <p>4 The sample number, instead of being just</p> <p>5 1A, it was 2-1A.</p> <p>6 Q 2-1A. Okay.</p> <p>7 A Yes. And the -- it was done as a net confining</p> <p>8 stress of 300 psi and a temperature of 150 degrees</p> <p>9 Fahrenheit.</p> <p>10 Q Was that to simulate reservoir conditions, or</p> <p>11 it seems different from the conditions in the testing?</p> <p>12 A I'm not sure why they only did 300 psi, but</p> <p>13 that's just the number they used.</p> <p>14 Q Is that the pressure exerted on the sample? Is</p> <p>15 that --</p> <p>16 A Yes. It's the amount of pressure that the</p> <p>17 sample is being held under from a -- for the testing.</p> <p>18 Q Would it -- it would -- how would that relate</p> <p>19 to permeability? If something's put under 300 psi --</p> <p>20 same substrate or same test sample is put under 300 psi</p> <p>21 pressure and then it's then put under 2,000 psi</p> <p>22 pressure, how would the permeability results be</p> <p>23 affected?</p> <p>24 A Well --</p> <p>25 Q Assuming the temperature would be the same.</p>
347	<p>1 because it's not exactly the same depth. Sample No. 1</p> <p>2 in the air permeability measurement was 6,071.52 feet,</p> <p>3 and Sample No. 1A was 6,071.28 feet. So it was adjacent</p> <p>4 to that first sample. And the apparent permeability to</p> <p>5 liquid ranges from 650 millidarcies to 591 millidarcies.</p> <p>6 Q Let's go on to the next sample, then, that's</p> <p>7 appropriate.</p> <p>8 A Okay. On Page 153 of TexCom Exhibit 11 is</p> <p>9 Sample No. 2-3, and it showed an apparent permeability</p> <p>10 of the liquid ranging from 341 millidarcies to 201</p> <p>11 millidarcies.</p> <p>12 Q Is that for Sample 2, then?</p> <p>13 A That's --</p> <p>14 Q 2-3, I think you said.</p> <p>15 A It was 2-3, and it was taken from a sample</p> <p>16 depth of 6077.55, which correlates to Sample No. 3 on</p> <p>17 the air permeability number.</p> <p>18 Q Okay. Please continue the next sample,</p> <p>19 whatever that might -- however it might be designated in</p> <p>20 the report.</p> <p>21 A Okay. And one thing I will note that for</p> <p>22 Sample 2-3, the testing was done at a net confining</p> <p>23 stress of 2,000 psi and a temperature of 150 degrees</p> <p>24 Fahrenheit to simulate, you know, as -- you know,</p> <p>25 simulate reservoir conditions.</p>	349	<p>1 I'm sorry.</p> <p>2 A It really depends on the sample, but basically</p> <p>3 you're squeezing it like, you know -- you know, as a</p> <p>4 very broad example, like you're squeezing a sponge. You</p> <p>5 know, if you put more pressure on it, it will hold less</p> <p>6 water. So it would reduce the permeability, you know,</p> <p>7 if the sand were to be able to be compressed.</p> <p>8 And that's what they're trying to simulate</p> <p>9 is it's under the same stress or pressure surrounding</p> <p>10 the rock that it is at depth, and so you're trying to</p> <p>11 simulate what it would be underground versus if it's on</p> <p>12 the surface with no pressure, the permeability would</p> <p>13 tend -- and porosity would tend to be higher,</p> <p>14 potentially.</p> <p>15 Q I see.</p> <p>16 A It really depends on the rock matrix.</p> <p>17 Q I see. Is there another sample that you could</p> <p>18 tell us the same information about?</p> <p>19 A Yes. Sample 2-1 on Page 155 of TexCom</p> <p>20 Exhibit 11. And it's at a sample depth of 6,071.52, and</p> <p>21 it's tested under a confining stress of 2,000 psi and</p> <p>22 150 degrees Fahrenheit. And the permeability ranges from</p> <p>23 345 -- let's see -- through 120 millidarcies.</p> <p>24 JUDGE EGAN: Which sample would that</p> <p>25 correlate to on the air permeability?</p>

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350	<p>1 WITNESS CASEY: Let's see here. It would</p> <p>2 correlate to Sample No. 1 of the air permeability.</p> <p>3 Q (BY MR. RILEY) And by "correlate," we're</p> <p>4 referring to depth of sample?</p> <p>5 A Yes. It's on -- at the same depth, so it's</p> <p>6 potentially the same piece of rock. But not having been</p> <p>7 there when they did the work, I can't say for sure they</p> <p>8 used the same plug for both tests.</p> <p>9 And let's see, on Page 157 of TexCom</p> <p>10 Exhibit 11, Sample No. 2-2, a sample depth of 6073.25,</p> <p>11 and that correlates to Sample No. 2 of the air</p> <p>12 permeability readings. And it was done at net confining</p> <p>13 stress of 2,000 psi and a temperature of 150 degrees</p> <p>14 Fahrenheit. And on this one, they injected -- for the</p> <p>15 fluid, they used 4 percent potassium chloride water,</p> <p>16 .5 percent potassium chloride water with a pH of 3.</p> <p>17 They used .5 percent potassium chloride water with a pH</p> <p>18 of 6. They used 4 percent potassium chloride water with</p> <p>19 a pH of 8, and they used 4 percent potassium chloride</p> <p>20 water with a pH of 9. They also used 4 percent</p> <p>21 potassium chloride water with a pH of 10.</p> <p>22 Q Mr. Casey, before you give us any further</p> <p>23 information, could you tell the judges why they would</p> <p>24 vary the pH and the salt concentration or the KCl</p> <p>25 concentration?</p>	352	<p>1 permeability to air measurement and then did the liquid</p> <p>2 permeability.</p> <p>3 Q Are any of the values you find in the -- in</p> <p>4 that report, are they -- 74 millidarcies indicated</p> <p>5 anywhere?</p> <p>6 A No, sir.</p> <p>7 Q Go back to the plot that Ms. Mendoza directed</p> <p>8 your attention to on Page 144.</p> <p>9 A Okay.</p> <p>10 Q Dropping out the outlier value, the Sample</p> <p>11 No. 5, I think you said earlier that you would have</p> <p>12 drawn the reference line or the line differently between</p> <p>13 the data points?</p> <p>14 A Yes, sir.</p> <p>15 Q And if you did that as you would do it, what</p> <p>16 would your estimate of permeability be in the same terms</p> <p>17 that Ms. Mendoza asked you about yesterday, with</p> <p>18 24 percent porosity?</p> <p>19 A At 24 percent porosity, it was around -- around</p> <p>20 200 millidarcies.</p> <p>21 But one thing I will note that within</p> <p>22 the -- within the five samples, not only did they</p> <p>23 measure permeability to air, but they also measured</p> <p>24 porosity and percent. And all the porosity numbers for</p> <p>25 the four samples that are not apparently shale have</p>
351	<p>1 A I believe they were doing so to test for</p> <p>2 compatibility issues with injection fluid. They might</p> <p>3 potentially be injected at the facility, so they look at</p> <p>4 the various -- you know, tested with different types of</p> <p>5 water to see what it does to the -- see if there's any</p> <p>6 reaction with the formation.</p> <p>7 Q Did they report permeability results based on</p> <p>8 the types of fluids?</p> <p>9 A Yes, they did. The permeability on this one</p> <p>10 ranges from 685 millidarcies -- well, let me take that</p> <p>11 back. It ranges from 949 millidarcies to 657.</p> <p>12 This last sample they did a little</p> <p>13 differently, and I think it's because it was the</p> <p>14 compatibility sampling. But they had a -- what they</p> <p>15 call an upstream and a downstream permeability</p> <p>16 measurement. And I'll be honest, I'm not exactly sure</p> <p>17 how they measure that within the reservoir, but it</p> <p>18 ranges from, you know, like I said, 949 down to 6 --</p> <p>19 around 639.</p> <p>20 And for each of these samples, they -- you</p> <p>21 know, they do have a permeability to air measurement,</p> <p>22 and I could go back through those, if you'd like.</p> <p>23 Because apparently -- in reading the chart, it looks</p> <p>24 like -- you know, not knowing exactly how they ran the</p> <p>25 samples, what order, but it looks like they did</p>	353	<p>1 permeabilities above 26 percent.</p> <p>2 Q You said permeabilities.</p> <p>3 A I mean -- I'm sorry -- porosity above</p> <p>4 26 percent.</p> <p>5 Q Above 26 percent.</p> <p>6 A The porosities for Sample No. 1 was</p> <p>7 31.7 percent; Sample No. 2 was 32.3 percent; for Sample</p> <p>8 No. 3, it was 26.8 percent; and Sample No. 4 was</p> <p>9 26.6 percent. And that porosity measurement was done at</p> <p>10 a 2,000 psi confining stress.</p> <p>11 Q Okay. Sample No. 5, did there -- was there</p> <p>12 porosity?</p> <p>13 A Yeah, Sample No. 5, the porosity was</p> <p>14 18 percent. If you look at the porosity at 0 confining</p> <p>15 stress or ambient pressures, Sample No. 1 is</p> <p>16 34.1 percent, Sample No. 2 is 33.4 percent, Sample No. 3</p> <p>17 is 27.7 percent, Sample No. 4 is 27.8 percent, and</p> <p>18 Sample No. 5 is 19.3 percent.</p> <p>19 Q Well, why is there a porosity value reported at</p> <p>20 formation pressures and one reported at ambient</p> <p>21 pressures? Is there a reason you can think of the</p> <p>22 company might do that?</p> <p>23 A Well, they just want to measure it at as close</p> <p>24 to actual conditions as they can simulate in the lab and</p> <p>25 then also at, you know, an ambient reading.</p>

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354	<p>1 Q Okay.</p> <p>2 A So, you know, with that information, I wouldn't</p> <p>3 have chosen 24 percent to draw my line to look at</p> <p>4 permeability. I would have moved it up to average of</p> <p>5 the first three, so somewhere around -- I don't know --</p> <p>6 20 -- let's call it 29 percent porosity as an average,</p> <p>7 off the top of my head, between the four upper readings,</p> <p>8 throwing out the fifth sample which is predominantly</p> <p>9 shale, but you would choose a higher porosity. And if</p> <p>10 you go to 29 percent on the table, you know, how I've</p> <p>11 re-drawn it, you're up around 400 millidarcies -- I</p> <p>12 mean, 400 millidarcies for the perm.</p> <p>13 Q Thank you, Mr. Casey. We're going to change</p> <p>14 topics, if that's okay with you.</p> <p>15 Yesterday you were asked a number of</p> <p>16 questions about the original application. I think it's</p> <p>17 in the same binder that you have before you, TexCom</p> <p>18 Exhibit 11. Oh, check that. Apparently it's in</p> <p>19 Exhibit 6. Let's get that in front of you.</p> <p>20 A I have it.</p> <p>21 Q Thank you. I believe Ms. Mendoza called your</p> <p>22 attention to Page 206.</p> <p>23 A Okay.</p> <p>24 Q And I think the topic of conversation was</p> <p>25 whether the original modeling submitted to the TCEQ</p>	356	<p>1 application treated three of the boundaries as closed.</p> <p>2 Is that correct?</p> <p>3 A That's correct.</p> <p>4 Q And then the fourth boundary being the boundary</p> <p>5 along the fault, the 4400-foot fault, as being open. Is</p> <p>6 that the way to say it or --</p> <p>7 A Basically. The -- with the BOAST model, it's</p> <p>8 still technically a closed boundary condition. You just</p> <p>9 adjust the outer boundary on the side of the fault to</p> <p>10 simulate moving into a higher perm zone. You're still</p> <p>11 limited to the ten-by-ten -- roughly, ten-by-ten model,</p> <p>12 but it's simulating a larger zone across the fault.</p> <p>13 Q Now that you've had a chance to reflect, do you</p> <p>14 believe that the original application of the modeling</p> <p>15 associated with it was misleading to the TCEQ?</p> <p>16 A No. It's exactly as we stated in the</p> <p>17 application.</p> <p>18 Q What's a packer? All right. Let me be more</p> <p>19 clear. What's a packer?</p> <p>20 A It's a mechanical device that you either set in</p> <p>21 the hole or attach to your tubing, but it provides a</p> <p>22 mechanical seal between the area below the packer in --</p> <p>23 within the well casing and the area above. In the</p> <p>24 annulus area, the area between the injection tubing and</p> <p>25 the casing, it provides a seal to prevent any fluid from</p>
355	<p>1 treated the boundaries as closed or infinite. Is that</p> <p>2 your recollection?</p> <p>3 A Yes, sir.</p> <p>4 Q And have you had a chance to reflect on</p> <p>5 Ms. Mendoza's line of questions since yesterday?</p> <p>6 A Yes, sir, I have.</p> <p>7 Q All right. And have you also checked with</p> <p>8 Dr. Lane?</p> <p>9 A Yes, I have.</p> <p>10 Q Tell the ALJs what now you understand the</p> <p>11 original modeling -- how the original modeling was done</p> <p>12 as it pertains to the boundary condition.</p> <p>13 A For the original modeling, it was set up with</p> <p>14 the closed boundary, but on the south side at the fault,</p> <p>15 it was -- at the fault, we increased the porosity to</p> <p>16 simulate moving into the middle Cockfield. So you had</p> <p>17 more zone available for pressure since the middle</p> <p>18 Cockfield is up against the lower Cockfield at the</p> <p>19 fault.</p> <p>20 Q And I recall that being a topic of -- a good</p> <p>21 deal of testimony in the last hearing. Do you have the</p> <p>22 same recollection?</p> <p>23 A Yes, sir. Yes.</p> <p>24 Q And so if I'm understanding your testimony</p> <p>25 today, then, the original modeling submitted with the</p>	357	<p>1 moving upward between the tubing and the casing.</p> <p>2 Q And so as I understand it, then, the purpose of</p> <p>3 a packer is to prevent fluid movement up the wellbore</p> <p>4 between the casing and the tubing? Is that correct?</p> <p>5 A That's correct. It's per UIC regulations, we</p> <p>6 have to have a packer that seals off that area and</p> <p>7 provides a layer of protection for the groundwater. And</p> <p>8 so what -- and as part of the annual testing you do on</p> <p>9 the well, you actually pressure test that area between</p> <p>10 the tubing and the casing to ensure you have what they</p> <p>11 call mechanical integrity.</p> <p>12 Q Was the mechanical integrity testing done as</p> <p>13 part of the 2009 fall-off test?</p> <p>14 A Yes, it was.</p> <p>15 Q All right. And was the well found to be in</p> <p>16 good condition from that perspective?</p> <p>17 A Yes, it passed all the mechanical integrity</p> <p>18 testing.</p> <p>19 Q Refresh my memory. Did the TCEQ attend that</p> <p>20 well testing?</p> <p>21 A Yes, a representative was there to witness.</p> <p>22 Q Do you know if anybody else -- any other party</p> <p>23 representatives attended that well testing?</p> <p>24 A Just the contractors working for me, myself,</p> <p>25 and two representatives from TCEQ.</p>

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358	<p>1 Q Do you know if the other parties had the</p> <p>2 opportunity to attend that well testing with the</p> <p>3 exception of Denbury who, of course, was not --</p> <p>4 A Yes.</p> <p>5 Q -- related to the case?</p> <p>6 A Everyone was notified of the testing and of the</p> <p>7 well that was going to take place.</p> <p>8 Q How about the conditions of the testing? Do</p> <p>9 you know whether the parties were provided with your</p> <p>10 protocol or the information that supports the issuance</p> <p>11 of the Class V permit?</p> <p>12 A Yes. All parties in the hearing received</p> <p>13 copies of the testing procedures.</p> <p>14 Q Did you receive any feedback from anybody, any</p> <p>15 source whatsoever, about the procedures?</p> <p>16 A I did not, no, sir.</p> <p>17 Q Ms. Mendoza asked you some questions about, as</p> <p>18 I understood them, at least, whether your modeling</p> <p>19 contemplated four injection wells. I think that was a</p> <p>20 line of questioning yesterday. Is that correct?</p> <p>21 A Yes, sir.</p> <p>22 Q And could you tell the ALJs -- well, let's</p> <p>23 start at the beginning.</p> <p>24 Did you include or consider four injection</p> <p>25 wells at the TexCom site?</p>	360	<p>1 Q If I understood you correctly, it would</p> <p>2 equalize at some point or it would be the same as if you</p> <p>3 were injecting the single 350 gallons per minute in one</p> <p>4 well for modeling purposes. Is that right?</p> <p>5 A Correct. It would -- you know, as the pressure</p> <p>6 plumes, as you say, from the four wells merged, it would</p> <p>7 act as a single well moving outward.</p> <p>8 Q Is it your opinion that the way you modeled --</p> <p>9 or by modeling one injection well at the maximum rate</p> <p>10 at -- over 30 years is a more conservative way to model</p> <p>11 than modeling four wells?</p> <p>12 A Yes, sir, it is.</p> <p>13 Q Ms. Mendoza asked you about whether your</p> <p>14 modeling contemplated any production wells. Do you</p> <p>15 remember those questions?</p> <p>16 A Yes, sir, I do.</p> <p>17 Q And did your modeling contemplate any</p> <p>18 production wells in the area?</p> <p>19 A No, sir. There's no production wells in the</p> <p>20 lower Cockfield.</p> <p>21 Q Well, Mr. Casey, is it -- there are production</p> <p>22 wells in the area. Is that correct?</p> <p>23 A Yes, there are.</p> <p>24 Q That was discussed at length in the prior</p> <p>25 hearing, too. Is that right?</p>
359	<p>1 A Well, they were -- the modeling took into</p> <p>2 account if there were four wells basically by the fact</p> <p>3 that, you know, the site is limited to 350 gallons a</p> <p>4 minute injection whether you're injecting into one well</p> <p>5 or into four wells. You're limited to that single rate.</p> <p>6 And so we modeled it as if all the</p> <p>7 injection was going down one well, because since the</p> <p>8 four wells were in close proximity, if you injected --</p> <p>9 you know, if you average the rate over four wells, you</p> <p>10 would -- over a short period of time, it would act as a</p> <p>11 single well because they're so close to each other. So</p> <p>12 you model it as a single well. It's the -- I guess it</p> <p>13 provides the highest pressure buildup at an individual</p> <p>14 well.</p> <p>15 Q The word we used a lot in the last hearing, at</p> <p>16 least, was "conservative." And what would conservative</p> <p>17 mean to you in the context of this discussion?</p> <p>18 A In the context of injection, if you go -- the</p> <p>19 most conservative is doing a single point of injection</p> <p>20 because you'll have the highest buildup at that single</p> <p>21 point rather than averaging it over four points, you</p> <p>22 know, in a -- I mean, how many -- you know, what that</p> <p>23 actual area is as far as acres. But if you averaged</p> <p>24 injection over four wells, your individual well pressure</p> <p>25 buildup would be less at that particular well.</p>	361	<p>1 A Yes, sir, it was.</p> <p>2 Q Switching topics again, there's been a good</p> <p>3 amount of discussion about modeling results,</p> <p>4 appropriately so in this case, at least in the prefiled</p> <p>5 testimony. And there are some models that have been</p> <p>6 used and -- I'm sorry -- said differently, there are</p> <p>7 different models that have been used by various experts</p> <p>8 in the case.</p> <p>9 A Yes.</p> <p>10 Q Is that your understanding?</p> <p>11 A Yes, sir, that's my understanding.</p> <p>12 Q Tell us again -- I think, again, this was</p> <p>13 covered in the prior hearing at some length, but the</p> <p>14 BOAST model, as I understand it, is considered a</p> <p>15 numerical model.</p> <p>16 A That's correct.</p> <p>17 Q Can you explain further what a numerical model</p> <p>18 is?</p> <p>19 A A numerical model, basically it's a model that</p> <p>20 allows you to build in parameters for changes in geology</p> <p>21 such as, you know, a dipping reservoir or, you know,</p> <p>22 a -- you can adjust it for changes in porosity,</p> <p>23 permeability, you know, in different cells within a</p> <p>24 reservoir. So if you had a known area such as a fault,</p> <p>25 you can model the fault, you know, what would happen at</p>

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<p style="text-align: right;">362</p> <p>1 the fault by changing the parameters at that cell.</p> <p>2 Unlike an analytical model which is a -- just a</p> <p>3 mathematical model.</p> <p>4 Q And do you know if TCEQ has guidance for UIC,</p> <p>5 underground injection control, permit applicants as to</p> <p>6 use of a model?</p> <p>7 A I don't remember exactly what -- you know, what</p> <p>8 they have as far as a model goes, but I know TCEQ uses</p> <p>9 the -- just went blank on the name of their model.</p> <p>10 Q Does --</p> <p>11 A PRESS2 model.</p> <p>12 Q -- PRESS2 sound familiar?</p> <p>13 A The PRESS2 model, which is an analytical model.</p> <p>14 Q And explain to us a little bit about the PRESS2</p> <p>15 model.</p> <p>16 A I personally haven't run the model, but the --</p> <p>17 it's a mathematical model, and it takes -- does not take</p> <p>18 into account geology. You base -- as far as if you had</p> <p>19 a slope or a dip to the formation, it does not take that</p> <p>20 into account. It's you're injecting into a single zone,</p> <p>21 and you put in the, you know, same parameters, you know,</p> <p>22 permeability, porosity, into that model that you do into</p> <p>23 a numerical model.</p> <p>24 Q And to refresh everyone as to -- let me set it</p> <p>25 up a little differently.</p>	<p style="text-align: right;">364</p> <p>1 non-transmissive, it increases further. Is that right?</p> <p>2 A That's correct.</p> <p>3 Q Similarly -- or that word that -- in a similar</p> <p>4 way, if we increase permeability and treat the fault as</p> <p>5 non-transmissive, the cone of influence would constrict.</p> <p>6 Is that right?</p> <p>7 A Can you say that again?</p> <p>8 Q Sure.</p> <p>9 If we treat the fault as non-transmissive</p> <p>10 but use a higher permeability number, then the fault --</p> <p>11 excuse me -- the cone of influence comes closer. The</p> <p>12 radius is smaller. Is that right?</p> <p>13 A That's correct.</p> <p>14 Q If we treat the fault as transmissive and leave</p> <p>15 the permeability at 80.9, then the cone of influence</p> <p>16 would come in also, would reduce. Is that right?</p> <p>17 A It would reduce compared to the fault being</p> <p>18 closed, yes, sir.</p> <p>19 Q Tell me again, or tell us again, the</p> <p>20 significance of the term "cone of influence."</p> <p>21 A Cone of influence is a calculated pressure at</p> <p>22 which the -- a mud-plugged well would start upward, it</p> <p>23 would initiate upward flow in a mud-plugged wellbore.</p> <p>24 Q So a mud-plugged wellbore is not one that's</p> <p>25 been cemented? Is that one way --</p>
<p style="text-align: right;">363</p> <p>1 Assuming all other inputs to be equal, how</p> <p>2 does a lower permeability in any type of model affect</p> <p>3 the radius of the cone of influence?</p> <p>4 A Lower perm would increase your cone of</p> <p>5 influence.</p> <p>6 Q Similar question as it pertains to the</p> <p>7 4400-foot fault.</p> <p>8 How does treating the 4400-foot fault as</p> <p>9 non-transmissive affect the radius of the cone of</p> <p>10 influence?</p> <p>11 A It would increase the cone of influence -- the</p> <p>12 fault south; it would increase the cone of influence,</p> <p>13 you know, to the north side and to the east and west</p> <p>14 along the fault. Since it's not allowing any of the</p> <p>15 fluid to transmit across the fault, all the pressure is</p> <p>16 held north of the fault, so your cone of influence would</p> <p>17 be larger on that side of the fault.</p> <p>18 Q And those were the two variables, as you</p> <p>19 understand it, that the TCEQ commissioners ordered us to</p> <p>20 analyze in this proceeding. Is that right?</p> <p>21 A That's correct.</p> <p>22 Q So let me see if I'm following. If we lower</p> <p>23 permeability, the cone of influence increases. Correct?</p> <p>24 A Correct.</p> <p>25 Q If we lower permeability and treat the fault as</p>	<p style="text-align: right;">365</p> <p>1 A Right.</p> <p>2 Q -- to think of it?</p> <p>3 A Correct. You're assuming it's plugged only</p> <p>4 with mud.</p> <p>5 Q And there was some questions about cement plugs</p> <p>6 and so on and depths in the well record. As a general</p> <p>7 matter, is a cement plug, is that placed on top of mud</p> <p>8 or is it the mud removed from a well? Could you explain</p> <p>9 a little more how that -- let's assume, for a second,</p> <p>10 there's a well drilled to a particular depth and then</p> <p>11 it's an unsuccessful well, dry hole, let's say, and one</p> <p>12 is required to plug the well. Is that right?</p> <p>13 A Yes, sir.</p> <p>14 Q In that condition, would the mud have been</p> <p>15 removed from the well?</p> <p>16 A No. No, it would still be -- it would be mud</p> <p>17 filled, and then they would put cement in there along</p> <p>18 with the mud.</p> <p>19 Q Okay. The microphone seemed to go in and out.</p> <p>20 Could you repeat that answer? I'm sorry.</p> <p>21 A The well would still be mud filled, and they</p> <p>22 would place the plugs within the mud-filled wellbore.</p> <p>23 Q As between a mud-filled wellbore and a</p> <p>24 mud-filled-but-plugged-at-depth-with-cement wellbore,</p> <p>25 which would be more resistant to fluid movement?</p>

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366	<p>1 A Can you restate that?</p> <p>2 Q Sure.</p> <p>3 I've got a wellbore that's just got mud in</p> <p>4 it, and then I've got a wellbore that has mud on the</p> <p>5 bottom of the wellbore, but at some depth it has a</p> <p>6 cement plug. Can you -- is that okay as a hypothetical?</p> <p>7 A Yes.</p> <p>8 Q Which of those two would be more resistant to</p> <p>9 fluid movement, in the context of our discussion, by</p> <p>10 movement -- greater pressure in a reservoir?</p> <p>11 A Well, the one with cement in there would be</p> <p>12 less prone to flow.</p> <p>13 Q So the -- as between those two examples, then,</p> <p>14 the number calculated that we use in this case, the</p> <p>15 421 psi, that would -- let me say it differently.</p> <p>16 The wellbore filled with mud, that's how</p> <p>17 that number is calculated. Right? Considering a</p> <p>18 wellbore filled with mud?</p> <p>19 A Yes, sir.</p> <p>20 Q All right. And so if the other one is more</p> <p>21 resistant to fluid movement, if we were calculating a</p> <p>22 pressure that would cause fluid movement in the wellbore</p> <p>23 with mud and cement, it would be higher. Is that --</p> <p>24 higher. Is that right?</p> <p>25 A Right. It would take more pressure to move it</p>	368	<p>1 review," and the alternative, then, is that your</p> <p>2 calculated cone of influence is greater than 2.5 miles.</p> <p>3 Is that a possibility?</p> <p>4 A Yes, it is.</p> <p>5 Q When you remodeled in this case the value, you</p> <p>6 and your team came up with was 2.94 miles. Is that</p> <p>7 right?</p> <p>8 A That's correct.</p> <p>9 Q And you did a well record search at the</p> <p>10 Railroad Commission within that radius. Is that true</p> <p>11 also?</p> <p>12 A Yes, it is.</p> <p>13 Q Now, as I started down the path earlier and I</p> <p>14 wanted to backtrack a little bit, other experts in this</p> <p>15 case disagree with your 2.94-mile calculation. Is that</p> <p>16 your understanding?</p> <p>17 A Yes, sir.</p> <p>18 Q And they think that the cone of influence is</p> <p>19 greater than 2.94 miles?</p> <p>20 A Yes, they do.</p> <p>21 Q Have you done any additional investigation of</p> <p>22 well records outside of the 2.94 miles since you learned</p> <p>23 of this disagreement?</p> <p>24 A Yes, we have.</p> <p>25 Q And what did you do precisely? By you, I mean</p>
367	<p>1 if there's cement in the wellbore.</p> <p>2 Q Are you aware that some folks disagree with</p> <p>3 your modeling in this case?</p> <p>4 A Yes, sir.</p> <p>5 Q And being aware of disagreement among</p> <p>6 experts -- I'm sorry. Let's just drop back just a step.</p> <p>7 Once one identifies a cone of influence in</p> <p>8 a case such as this, what is the next task at hand?</p> <p>9 A To build the model and calculate the pressure</p> <p>10 buildup to determine how far away from the well you -- I</p> <p>11 don't know what's going on with the microphone here.</p> <p>12 But you do your modeling and then</p> <p>13 calculate how far away from the well that your pressure</p> <p>14 in the reservoir drops below the cone of influence</p> <p>15 pressure, and that, at that point, is the distance that</p> <p>16 your cone of influence extends.</p> <p>17 Q Now, my understanding of that is if it's within</p> <p>18 2.5-mile radius, then one would still look for</p> <p>19 artificial penetrations within that 2.5-mile radius. Is</p> <p>20 that correct?</p> <p>21 A Yes. TCEQ rules state that if your cone of</p> <p>22 influence is less than two-and-a-half-mile radius, than</p> <p>23 you still maintain a two-and-a-half mile as your radius</p> <p>24 of investigation for your area of review.</p> <p>25 Q All right. So let's use the term now "area of</p>	369	<p>1 you and your team.</p> <p>2 A Yes. We sent some staff over to the Railroad</p> <p>3 Commission to gather records out to four-and-a-half</p> <p>4 miles from the injection well site.</p> <p>5 MR. RILEY: Could I have just a minute</p> <p>6 judges?</p> <p>7 (Brief pause)</p> <p>8 MR. RILEY: I need to get an exhibit</p> <p>9 prepared, if you'll just give me a second.</p> <p>10 JUDGE WALSTON: While you're getting that</p> <p>11 exhibit, Mr. Riley, let me ask you: Now, are you moving</p> <p>12 into rebuttal testimony at this point?</p> <p>13 MR. RILEY: I don't think so, Judge, but</p> <p>14 since I'm not sure what time will allow and I think this</p> <p>15 is legitimate redirect because it's some of the</p> <p>16 questions about well records. But it is something I</p> <p>17 could do on rebuttal, but to be conservative and sort of</p> <p>18 economize with time and expert time, particularly, I'd</p> <p>19 like to put them in now. In all likelihood, as everyone</p> <p>20 knows, Mr. Casey will be back on rebuttal, but I haven't</p> <p>21 made that decision yet -- or we haven't made that</p> <p>22 decision yet, so -- and this should only take a minute,</p> <p>23 by the way.</p> <p>24 JUDGE WALSTON: Wait. Just tell -- what</p> <p>25 exhibit are you going to now?</p>

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370	<p>1 MR. RILEY: That's a good question.</p> <p>2 MR. LEE: 94.</p> <p>3 MR. RILEY: 94.</p> <p>4 (Exhibit TexCom No. 94 marked)</p> <p>5 MR. RILEY: I'm not sure if the copy has</p> <p>6 been marked, provided to the witness. And I'd ask that</p> <p>7 it be marked TexCom -- oh, this is off the record.</p> <p>8 (Discussion off the record)</p> <p>9 MR. RILEY: And, Judges, just so you know,</p> <p>10 as a housekeeping matter, so to speak, these records</p> <p>11 have been provided as a disclosure to the parties prior</p> <p>12 to this morning. We gave them a new binder or a binder</p> <p>13 for each party just so it would be convenient and</p> <p>14 everyone would have it in front of them.</p> <p>15 Q (BY MR. RILEY) Mr. Casey -- excuse me -- could</p> <p>16 you look at what's been now marked as TexCom Exhibit 94?</p> <p>17 A Yes, sir.</p> <p>18 Q Could you tell the administrative law judges</p> <p>19 what is contained in Exhibit 94?</p> <p>20 A These are the well records that we located for</p> <p>21 wells between the 2.94 radius and 4.5 miles from the</p> <p>22 TexCom injection well site.</p> <p>23 Q Were these well records gathered in a similar</p> <p>24 fashion to the other well records that are in evidence</p> <p>25 in this case?</p>	372	<p>1 information of what documents were retrieved and status</p> <p>2 of the well.</p> <p>3 Q (BY MR. RILEY) Have you reviewed the</p> <p>4 information in that table?</p> <p>5 A Yes, I have.</p> <p>6 Q And is it accurate to the best of your</p> <p>7 knowledge?</p> <p>8 A To the best of my knowledge, it's accurate,</p> <p>9 yes, sir.</p> <p>10 Q And is it supported by the documents that</p> <p>11 follow beyond the table, the Railroad Commission</p> <p>12 records?</p> <p>13 A Yes, it is.</p> <p>14 MR. RILEY: Your Honor, at this time</p> <p>15 Applicant moves for Exhibit 94 -- TexCom Exhibit 94 be</p> <p>16 admitted into evidence.</p> <p>17 JUDGE WALSTON: Any objection?</p> <p>18 (No response)</p> <p>19 JUDGE WALSTON: There being no objections,</p> <p>20 TexCom Exhibit 94 is admitted.</p> <p>21 (Exhibit TexCom No. 94 admitted)</p> <p>22 MR. RILEY: Could I have just a moment? I</p> <p>23 think I'm through, but I'll just confer.</p> <p>24 Thank you, Your Honor. I pass the</p> <p>25 witness.</p>
371	<p>1 A Yes, they were.</p> <p>2 Q And if I understand correctly, they are</p> <p>3 gathered from Railroad Commission records. Is that</p> <p>4 correct?</p> <p>5 A Yes, from the Railroad Commission records.</p> <p>6 Q Without going into detail on each of the</p> <p>7 records at this time, generally speaking, are there</p> <p>8 wells identified between 2.94 miles and 4.5 miles that</p> <p>9 are of concern to you in this case? And by "concern," I</p> <p>10 mean that would be possible pathways for migration out</p> <p>11 of the Cockfield Formation.</p> <p>12 A No, not at this.</p> <p>13 Q Mr. Casey, would you turn to what has been</p> <p>14 identified as -- or I'm sorry -- is labeled in the</p> <p>15 Exhibit 94 as APP1009902?</p> <p>16 A Yes, sir.</p> <p>17 Q And could you tell the administrative law</p> <p>18 judges what is represented in that table?</p> <p>19 JUDGE WALSTON: Can you give us a --</p> <p>20 MR. RILEY: I'm sorry. It's a summary</p> <p>21 page.</p> <p>22 A This is a table of all the wells between 2.94</p> <p>23 and 4.5 miles that were located. It gives the -- a map</p> <p>24 reference number, lease name, original operator as</p> <p>25 listed on the record, and then the total depth and</p>	373	<p>1 JUDGE WALSTON: Does Lone Star have any</p> <p>2 further cross?</p> <p>3 MR. HILL: The district does, Your Honor.</p> <p>4 JUDGE WALSTON: Okay.</p> <p>5 MS. MENDOZA: Excuse me. Would it be</p> <p>6 possible to take a brief two-minute break before we</p> <p>7 continue with --</p> <p>8 JUDGE WALSTON: Well, it's already after</p> <p>9 10:00, so we can just go ahead and take our morning</p> <p>10 break. We'll take a break and come back at 10:25.</p> <p>11 We'll go off the record.</p> <p>12 (Recess: 10:07 a.m. to 10:26 a.m.)</p> <p>13 JUDGE WALSTON: Okay. We'll go back on</p> <p>14 the record.</p> <p>15 Mr. Hill?</p> <p>16 MR. HILL: Thank you, Your Honors.</p> <p>17 RECROSS-EXAMINATION</p> <p>18 BY MR. HILL:</p> <p>19 Q Good morning, Mr. Casey.</p> <p>20 A Good morning.</p> <p>21 Q I just have a handful of questions that I would</p> <p>22 like the chance to get some clarification from you on.</p> <p>23 First of all, let me -- I'd like to</p> <p>24 explore this issue that Mr. Riley raised about your</p> <p>25 Class V authorization that you operated under to conduct</p>

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374	<p>1 your fall-off test.</p> <p>2 A Yes, sir.</p> <p>3 Q In September 2009.</p> <p>4 A Yes, sir.</p> <p>5 Q Okay. You recall the application process that</p> <p>6 you and ALL Consulting went through to obtain that</p> <p>7 authorization?</p> <p>8 A Yes, sir.</p> <p>9 Q Okay. How many -- well, let me take a step</p> <p>10 back.</p> <p>11 Can you explain to the judges the -- what</p> <p>12 a Class V authorization is?</p> <p>13 A Well, basically, they used a Class V permit to</p> <p>14 allow us to do the injection test.</p> <p>15 Q Do you -- can you explain the significance of</p> <p>16 the V designation compared to a Class I designation?</p> <p>17 A Well, a Class V well is typically a well that</p> <p>18 injects into or above USDW. A lot of times it's used</p> <p>19 for like aquifer storage and recovery wells, typical</p> <p>20 Class V well, but they have used them in the past to</p> <p>21 allow different types of injection wells. It's kind of</p> <p>22 a -- just a process that the TCEQ could use to allow the</p> <p>23 testing.</p> <p>24 Q So it was the regulatory vehicle -- I think we</p> <p>25 established yesterday or day before, perhaps, it's the</p>	376	<p>1 that you might have been required to notify as part of</p> <p>2 your Class I application?</p> <p>3 A I honestly don't remember if we had to</p> <p>4 notify -- if there was any requirement to notify.</p> <p>5 Q Okay. So you don't -- you can't say</p> <p>6 specifically that members of the public, outside of the</p> <p>7 parties that are represented in this contested case,</p> <p>8 ever were made aware of your Class V authorization?</p> <p>9 A I have -- I don't know.</p> <p>10 Q Okay. Fair enough.</p> <p>11 Now, you testified earlier that you</p> <p>12 received no feedback from anybody and specifically from</p> <p>13 any parties in this contested case regarding your</p> <p>14 Class V authorization. Was that your testimony?</p> <p>15 A I don't remember ever receiving a letter or</p> <p>16 anything in the mail from anybody.</p> <p>17 Q Okay. But you can't say that any feedback was</p> <p>18 even procedurally possible, can you?</p> <p>19 A That, I don't know.</p> <p>20 Q Okay. But you did receive some feedback from</p> <p>21 the TCEQ, did you not?</p> <p>22 A I don't remember the exact process. It's been</p> <p>23 a while since we did it. I can't remember if we went</p> <p>24 through an NOD-type scenario or not.</p> <p>25 Q Okay. Do you have TexCom Exhibit No. 89 at</p>
375	<p>1 regulatory vehicle that gives you the ability to inject</p> <p>2 your testing fluids that you have to be able to do in</p> <p>3 order to conduct a fall-off test. Is that correct?</p> <p>4 A Yes. It's the method that they used to allow</p> <p>5 us to do the testing.</p> <p>6 Q Can I -- do you mind, for my own edification,</p> <p>7 telling me and the judges how many Class V</p> <p>8 authorizations you've ever applied for in your career?</p> <p>9 A This is the first Class V I've ever applied</p> <p>10 for.</p> <p>11 Q Okay. Do you know if, then, typically Class V</p> <p>12 authorizations are subject to public notice?</p> <p>13 A That, I don't know.</p> <p>14 Q Do you --</p> <p>15 A I don't know the process for a Class V</p> <p>16 authorization.</p> <p>17 Q Okay. Are you familiar enough with the process</p> <p>18 you went through on this one to answer -- talk about</p> <p>19 some of the procedural steps you had to go through to</p> <p>20 get it?</p> <p>21 A We prepared the application and submitted it to</p> <p>22 TCEQ.</p> <p>23 Q Okay. As part of that application, were you</p> <p>24 required to identify any adjacent landowners or mineral</p> <p>25 interest owners or any other persons other than the TCEQ</p>	377	<p>1 your disposal here?</p> <p>2 No pun intended, I'm sorry.</p> <p>3 A Yes, sir, I do.</p> <p>4 Q Okay. Do you recognize -- well, we -- you</p> <p>5 provided some testimony on some questions that I had</p> <p>6 previously about TexCom Exhibit No. 89.</p> <p>7 You recognize this document, do you not?</p> <p>8 A Yes, sir, I do.</p> <p>9 Q Okay. Does seeing this document refresh your</p> <p>10 recollection about feedback you might have received from</p> <p>11 TCEQ in response to your Class V authorization?</p> <p>12 A Yes. It appears we did a round of Notice of</p> <p>13 Deficiency answers.</p> <p>14 Q Okay. Are you aware of whether parties to this</p> <p>15 contested case were made aware of or were provided</p> <p>16 copies of this correspondence?</p> <p>17 A I'm not sure.</p> <p>18 Q If, assuming hypothetically, they were at or</p> <p>19 around June 12th, 2009, would you -- would you say that</p> <p>20 it's fair for folks that might be looking at this letter</p> <p>21 that are not ALL Consulting or TCEQ to interpret this to</p> <p>22 suggest that TCEQ was providing feedback on your</p> <p>23 application?</p> <p>24 A I guess it could be seen that way, yes, sir.</p> <p>25 Q Okay. In all this discussion about -- with the</p>

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378	<p>1 permeability of the lower Cockfield Formation at 315 may 2 or may not be, let me just ask you, if the sky was the 3 limit and you had your pick of the litter, so to speak, 4 of any method economically feasible to determine what 5 the permeability of the lower Cockfield Formation is, 6 what would that method be?</p> <p>7 A Well, you know, permeability is a -- I don't 8 believe you can ever get to a single number for 9 permeability. It's usually a range of permeabilities. 10 And core testing is usually your best method because 11 it's an actual sample of the rock.</p> <p>12 Q Okay. So just to make sure I understand you 13 correctly, if -- and I understand what you're saying 14 about your difficulty or your lack of confidence in 15 being able to nail down a specific permeability for a 16 formation. But just so I understand your testimony 17 correctly, of all of the methods that might be available 18 to you to determine the most reliable value for 19 permeability that you can provide for yourself, you're 20 telling me that core sampling is your preferred method?</p> <p>21 A Well, I mean, I don't rely on a single method 22 because it is tough to get to a -- you know, a single 23 number. That's why we typically -- on these Class I 24 wells, we have core sampling. Then we have the 25 injection testing. And you review that and you review</p>	380	<p>1 permeability in that formation, is that an appropriate 2 way to ascertain how that formation is going to accept 3 waste and determine how that formation is going to 4 pressure up over time of injection operations?</p> <p>5 A Well, you're asking if our estimation of 6 permeability -- you know, by coming to an estimate for 7 permeability and looking at that over time is the best 8 way to see how the well is going to react, that's about 9 the only way we can do it, is to estimate permeability, 10 put it into an analytical numerical model, and see what 11 the effect is over time.</p> <p>12 Q Specifically, I'm -- I apologize for the 13 confusing question.</p> <p>14 But specifically, I'm interested in the 15 average permeability. And I understand that that still 16 may be an estimate for you, but I'm interested in 17 averaging permeability -- let me take a step back.</p> <p>18 The lower Cockfield Formation contains 19 various types of sands and shales, does it not -- or 20 various layers of sands and shales, does it not?</p> <p>21 A That's correct.</p> <p>22 Q Okay. Those sands and shales were created over 23 geologic time by deposits of sand and different marine 24 material that accumulated and formed that particular 25 part of the formation. Is that right?</p>
379	<p>1 other data from, you know, regional data that you can 2 find to come to a estimation of what the permeability 3 is.</p> <p>4 Q And I understand that there are multiple ways 5 to determine permeability, and are you suggesting that 6 there's no one way that is more reliable than any other 7 or there -- one is less reliable than all the others?</p> <p>8 A I -- you know, in all honesty, it's -- I don't 9 believe there's a single method you could use. You're 10 really -- you know, in order to get a good estimation of 11 permeability, you really need to adapt more than one 12 method.</p> <p>13 Q Okay. And isn't it true, though, that when 14 we're trying to ascertain how the formation -- and to be 15 specific in this case, the lower Cockfield at WDW315 -- 16 is going to accept your wastewater and is going to react 17 to the pressuring that results from your injection 18 activities, is it a fair conclusion to make that what we 19 want to know is how that formation is going to act, on 20 average, over a given time of injection activity?</p> <p>21 A Can you restate that? Make sure I followed 22 you.</p> <p>23 Q Fair enough.</p> <p>24 Is viewing the permeability of an 25 injection interval from the perspective of the average</p>	381	<p>1 A That's correct.</p> <p>2 Q Okay. Within those various layers of 3 deposition, are some sands going to have a different 4 permeability from, perhaps, other sands within the lower 5 Cockfield?</p> <p>6 A Yes.</p> <p>7 Q Okay. And the same, I suspect, is true for the 8 shales that might have been embedded within the lower 9 Cockfield. Some shales may be more dense, perhaps is 10 the right word, less permeable than other shales within 11 the formation?</p> <p>12 A From a shale perspective, if it's, you know, 13 truly a shale, then it's all low. I mean, that's --</p> <p>14 Q Fair enough. My point is, is that there are 15 various strata, even within the lower Cockfield, of 16 varying degrees of permeable material. Is that correct?</p> <p>17 A Yes, sir.</p> <p>18 Q Okay. And so as you inject into the lower 19 Cockfield, is the formation going to react over time as 20 though only one particular segment of that sand that may 21 have a -- the most favorable permeability in the entire 22 strata is taking that waste or is it going to act over 23 time as an average permeability?</p> <p>24 A It would be an average.</p> <p>25 Q Okay. My question, then, is in determining --</p>

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382	<p>1 and so from a modeling perspective -- let me take</p> <p>2 another step.</p> <p>3 From a modeling perspective, accounting</p> <p>4 for what that average is or might be would be important</p> <p>5 from a -- from developing a cone of influence. Is that</p> <p>6 correct?</p> <p>7 A Right. That's why when we do our analysis up</p> <p>8 front, we try and look at -- you know, when we're trying</p> <p>9 to choose a permeability number, we look for, you know,</p> <p>10 what would be a good, average permeability for the</p> <p>11 reservoir.</p> <p>12 Q Okay. Of all of the sands that are available</p> <p>13 for injection in the lower Cockfield, can you tell me</p> <p>14 whether or not WDW410 or 315 is now perforated to inject</p> <p>15 into those sands?</p> <p>16 A You know, in looking at the perforation record,</p> <p>17 you know, we've perforated most of the sands. Whether,</p> <p>18 you know -- one of the problems you run into when you're</p> <p>19 perforating a well is you're correlating a wireline tool</p> <p>20 against an existing log and trying to get on depth with</p> <p>21 where you're at. And so you're -- you know, you come</p> <p>22 out of the well. You put your, you know, perforating,</p> <p>23 you know, gun, as they say, on the tool, run it back in</p> <p>24 the well to the specified depth as you correlated</p> <p>25 previously.</p>	384	<p>1 you know, having perforations at -- you know, it closed</p> <p>2 up over time through, you know, scale buildup or</p> <p>3 whatever. There's -- operationally, you know, there are</p> <p>4 injection wells that from time to time, you have to just</p> <p>5 reperforate the same zone just because it's not acting</p> <p>6 like it should because of, you know, mechanical issues.</p> <p>7 Q I understand the reference to reperforation.</p> <p>8 But my question specifically, though, is: Based on what</p> <p>9 you know of the lower Cockfield and based on what you</p> <p>10 know of TexCom's proposed operations, are you able to</p> <p>11 say right now whether TexCom may in the future have</p> <p>12 additional sands in the lower Cockfield that it may want</p> <p>13 to perforate into that currently WDW410 is not</p> <p>14 perforated to inject into?</p> <p>15 A At this time, I don't know what the -- if</p> <p>16 they'd want to do any additional perforating.</p> <p>17 Q And all the testing that you conducted on 315</p> <p>18 in September of 2009 or at any point in time, have you</p> <p>19 been able to identify any additional sands in the lower</p> <p>20 Cockfield that you believe are favorable for injection</p> <p>21 that 315 is currently not perforated into now?</p> <p>22 A I haven't relogged the well since we perforated</p> <p>23 to see if we missed a sand as to where the perforations</p> <p>24 actually ended up. At the time, I believe, we're -- you</p> <p>25 know, we perforated the majority of the sands available.</p>
383	<p>1 There is the -- you know, what happens</p> <p>2 time after time is you get off, you know, a foot or half</p> <p>3 a foot either direction due to line stretch or, you</p> <p>4 know, poor placement by the perforating company.</p> <p>5 To the best of our knowledge, you know,</p> <p>6 we've perforated, you know, some of the better parts of</p> <p>7 the sand. There may be, you know, through additional</p> <p>8 logging over time, you know, as we go back into the well</p> <p>9 and do stuff, we may find that we missed, you know, a</p> <p>10 one or two sands within the reservoir and may want to,</p> <p>11 at some point in the future, have to reperforate or, you</p> <p>12 know, add more perforations within our injection</p> <p>13 interval to assist the fluid leaving the wellbore and</p> <p>14 maybe, you know, getting across from one or two more</p> <p>15 sands. It's -- you know, that's an operational issue as</p> <p>16 you go through time. That's how the well, you know,</p> <p>17 reacts over time.</p> <p>18 Q Just to be clear, then, is it possible, based</p> <p>19 on what you know of TexCom's proposed operations and</p> <p>20 what you understand of the lower Cockfield today at 315,</p> <p>21 that there may be a point in time where TexCom wants to</p> <p>22 add additional perforations or perforate into additional</p> <p>23 sands within the lower Cockfield?</p> <p>24 A There might be a chance in time where we want</p> <p>25 to, you know, reperforate the existing interval due to,</p>	385	<p>1 Q Okay. I just -- I want to see if I can get a</p> <p>2 clear answer from you on this because I want to make</p> <p>3 sure I understand your testimony.</p> <p>4 Are you aware right now of any sands in</p> <p>5 the lower Cockfield that would be favorable for</p> <p>6 injection at WDW315 that TexCom currently is not</p> <p>7 perforated to inject into today?</p> <p>8 A At this time, I couldn't tell you for sure.</p> <p>9 Q Okay. So the answer is, no, you're not aware?</p> <p>10 A Well, like I said, I haven't relogged it since</p> <p>11 we perforated to see exactly where the perforations</p> <p>12 ended up. So if we missed a portion of the sand, at</p> <p>13 some point in the future, we may want to go back and</p> <p>14 reperforate that portion of sand.</p> <p>15 Q Do you have any indication today that you</p> <p>16 missed a portion of any sand that's favorable for</p> <p>17 injection at 315?</p> <p>18 A At this time, no.</p> <p>19 Q Okay. You spent a fair amount of time with</p> <p>20 Mr. Riley explaining or discussing the coring analysis</p> <p>21 that was conducted by the previous permit holder on 315.</p> <p>22 I don't have it in front of me, but I believe it was</p> <p>23 TexCom Exhibit 11 that had all that core analysis. Is</p> <p>24 that correct? I'm not asking you necessarily to turn to</p> <p>25 it, but --</p>

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<p style="text-align: right;">386</p> <p>1 A I think so, yes, sir.</p> <p>2 Q You may need to turn to it, but perhaps not.</p> <p>3 Can you help me understand how many</p> <p>4 samples total were taken in that coring that was</p> <p>5 conducted on 315 at the time it was being completed --</p> <p>6 drilled and completed?</p> <p>7 A I can't give you the exact number because I</p> <p>8 haven't seen it where they said they took ten plugs or</p> <p>9 12 plugs in the write-up. I didn't see that. But</p> <p>10 looking at the samples, I know they at least took five.</p> <p>11 We saw on an air permeability table, there was five.</p> <p>12 There's a couple of depths in the permeability to water</p> <p>13 tables that look like they might have taken a few more</p> <p>14 samples.</p> <p>15 And I'm not sure. Even the samples at the</p> <p>16 same depth, whether it was the same actual plug that</p> <p>17 they used for the air perm measurement and the water</p> <p>18 perm, I can't -- I wasn't there when they did it, so I</p> <p>19 can't tell you if it was one plug or two at that depth.</p> <p>20 Q Okay. So there's a potential, then, just so I</p> <p>21 understand, that there may be two different sets of</p> <p>22 plugs that were actually tested in some point in time?</p> <p>23 Is that -- am I understanding that right?</p> <p>24 A Well, there -- all the sampling was done at the</p> <p>25 same time. I mean, they had the core at that one time,</p>	<p style="text-align: right;">388</p> <p>1 then, there were discrete sampling plugs taken from</p> <p>2 that --</p> <p>3 A Yes.</p> <p>4 Q -- piece of core? Is that correct?</p> <p>5 A That's correct.</p> <p>6 Q Okay. And your testimony is somewhere between</p> <p>7 five and ten of those sampling plugs were taken, to the</p> <p>8 best of your knowledge?</p> <p>9 A Yes, sir.</p> <p>10 Q Okay. Can you explain just physically the</p> <p>11 dimensions -- if you know, specifically the dimensions</p> <p>12 of those sampling plugs that were taken?</p> <p>13 A Specifically, I don't know, you know, the ones</p> <p>14 they used. Typically, they're about one-inch diameter</p> <p>15 cores, you know, two to three inches in length, just</p> <p>16 depends on how they did it at that time. I'm not a core</p> <p>17 analysis specialist, but typically, it's a one-inch plug</p> <p>18 taken out of the core.</p> <p>19 Q Okay. So do you have any reason to believe,</p> <p>20 based on your pretty thorough analysis of that core</p> <p>21 report, that the process Omni followed here was</p> <p>22 atypical?</p> <p>23 A No, it's -- seems to be fairly typical.</p> <p>24 Q Okay. So then it's safe to assume -- you tell</p> <p>25 me if it's safe to assume, then, that out of all the</p>
<p style="text-align: right;">387</p> <p>1 did all the analysis. But I can't tell you if they took</p> <p>2 five samples, or I think it would be nine or ten total.</p> <p>3 If they were -- if each permeability measurement was a</p> <p>4 separate sample, then it would have been, you know,</p> <p>5 eight or nine, nine or ten.</p> <p>6 Q Okay. Can you explain, for my edification, the</p> <p>7 process that you go to when you're doing core work? In</p> <p>8 other words, I understand that we've got some number of</p> <p>9 samples, whatever they may be. Do those -- are those a</p> <p>10 product of some bigger coring that's taken?</p> <p>11 A Yes. They took a whole core, they call it.</p> <p>12 It's typically around a four-inch core sample.</p> <p>13 Q Just four inches in diameter?</p> <p>14 A Four inches in diameter.</p> <p>15 Q Okay.</p> <p>16 A And then however long it was. And then --</p> <p>17 Q Well, before you -- I don't mean to interrupt,</p> <p>18 but I think this is important.</p> <p>19 Do you know how long that four-inch</p> <p>20 diameter core was?</p> <p>21 A I don't see anywhere where it actually states</p> <p>22 they had, you know, a certain length of core; but in</p> <p>23 looking at just the core gamma ray plot, it looks like</p> <p>24 somewhere between 14 and 15 feet of core.</p> <p>25 Q Okay. And so from that 14 or 15 feet of core,</p>	<p style="text-align: right;">389</p> <p>1 coring work that was conducted at 315, we have a</p> <p>2 maximum, most likely, of -- if I'm doing the math</p> <p>3 correctly -- 30 inches of sampled material that were</p> <p>4 actually tested when you add all the lengths of those</p> <p>5 sampling plugs together?</p> <p>6 A I mean, they took, you know, somewhere between</p> <p>7 five and ten plugs that are one inch by two to three</p> <p>8 inches. I mean, it's -- and, you know, I don't know if</p> <p>9 they drilled them horizontally or vertically through the</p> <p>10 core. It's -- you know, I wasn't there, and I didn't</p> <p>11 see it in the report, so...</p> <p>12 Q I understand. Do you have any reason to</p> <p>13 believe that the, you know, from a depth standpoint, if</p> <p>14 you were to stack all of the plugs together, whichever,</p> <p>15 you know, dimension might be -- you know, whether it was</p> <p>16 taken from the side or down from the top, whether we</p> <p>17 would have any more than three feet of material that was</p> <p>18 sampled total?</p> <p>19 A I would guess that's a good estimation.</p> <p>20 Q Okay. And if I understood your testimony</p> <p>21 correctly, some of that material was a shale that was --</p> <p>22 resulted in a very low permeability reading. Is that</p> <p>23 right?</p> <p>24 A That's correct.</p> <p>25 Q Okay. So out of the three feet that was</p>

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<p style="text-align: right;">390</p> <p>1 sampled from WDW315, some component of that was a shale, 2 was it not?</p> <p>3 A It was a, you know, higher proportion of shale 4 in that fifth sample.</p> <p>5 Q Okay. High enough to give you a relatively -- 6 a single-digit permeability?</p> <p>7 A That's correct.</p> <p>8 Q All right. And so since TexCom or ALL 9 Consulting -- or TexCom through ALL Consulting has not 10 determined today the presence of any favorable sands in 11 the lower Cockfield at WDW315, sands that would be 12 favorable for injection that aren't currently perforated 13 into, is it fair to say, then, that when we're trying to 14 determine our average, the 145 feet of sands that are 15 currently perforated into -- that 315 is perforated into 16 is the appropriate depth to assess that average?</p> <p>17 MR. RILEY: Objection. The objection -- 18 and I think we can reach a resolution to this. I think 19 the word should be "more favorable." The question was 20 whether there are any favorable sands. It's our 21 position that the sands identified are favorable, but I 22 think counsel's question is more favorable sand than 23 what's been identified.</p> <p>24 MR. HILL: I'll accept the clarification 25 there, and indeed, I meant since -- let me just rephrase</p>	<p style="text-align: right;">392</p> <p>1 and at other data that might be available to you.</p> <p>2 Q Perhaps, like a fall-off test analysis?</p> <p>3 A Fall-off test or any other information 4 available.</p> <p>5 Q Okay. Help me. What other information might 6 we turn to?</p> <p>7 A Sometimes we may get regional information, you 8 know, publications, you know...</p> <p>9 Q And when we talk about "regional information," 10 we're talking literally, like textbooks or treatises or 11 compilations of studies of the area?</p> <p>12 A Right. Exactly.</p> <p>13 Q Okay. And how were those -- and let me ask you 14 some questions about those.</p> <p>15 How were those treatises or textbooks or 16 compilations of studies of the area, was there any 17 particular motivation that generated that -- the 18 development of that understanding, and specifically, in 19 the Conroe oil field?</p> <p>20 A You know, as part of the Class I application, 21 you're required to do a regional analysis and then a 22 local analysis and then a well analysis.</p> <p>23 Q I understand. And what I'm trying to get to is 24 how -- what motivated the development of that regional 25 analysis? Was that something that you undertook, or was</p>
<p style="text-align: right;">391</p> <p>1 the question, and see if I can get us past this.</p> <p>2 Q (BY MR. HILL) If I understand your testimony 3 correctly, you are not aware of any more favorable sands 4 in the lower Cockfield above and beyond what has 5 currently perforated into a 315. Is that correct?</p> <p>6 A That's correct.</p> <p>7 Q Okay. So when we're trying to assess how the 8 lower Cockfield is going to accept waste and create 9 pressures because of the permeability of that formation 10 as an average over time, 145 feet of sands is the 11 appropriate thickness that we need to work from in 12 determining that average. Is that correct?</p> <p>13 A That's correct.</p> <p>14 Q Okay. And I just want to make sure I 15 understand your testimony that this three feet of 16 material that was sampled through coring work, some of 17 which was -- had a higher shale component than others, 18 from that three feet of material, we can get a reliable 19 average assessment of the permeability of the lower 20 Cockfield?</p> <p>21 A You can get an assessment of the permeability.</p> <p>22 Q Okay. Of the entire 145-foot interval?</p> <p>23 A Well, your assessment is the portion there.</p> <p>24 Then you add -- you know, in looking at the -- you know, 25 determining your average for modeling, you look at that</p>	<p style="text-align: right;">393</p> <p>1 that something -- was that work that had already existed 2 before TexCom's Class I application was even conceived?</p> <p>3 A Was my analysis done before? I guess I'm a 4 little confused on that question.</p> <p>5 Q Fair enough.</p> <p>6 We -- I talked a minute ago or I mentioned 7 treatises and various writings and whatnot. Did you 8 specifically compile treatises and writings based on 9 what you learned from 315 to determine the regional 10 analysis there that you relied upon, or were there other 11 works in existence at the time that you turned to as 12 part of that regional analysis?</p> <p>13 A We used other documents that had been put 14 together.</p> <p>15 Q Okay. And what I'm trying to get at is, 16 generally speaking, or specifically, if you can give me 17 some specific examples, would you agree or would you not 18 agree that most of those regional analyses were the 19 product of knowledge that was gained during oil and gas 20 exploration and production of the Conroe oil field?</p> <p>21 A I can't specifically say that it all came from 22 there because I didn't -- you know, personally didn't 23 review every document written, so...</p> <p>24 Q Is hydrocarbon production or the hydrocarbon 25 production industry responsible for at least a</p>

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<p style="text-align: right;">394</p> <p>1 significant component of these geologic studies that you 2 might have relied upon in your assessment of regional 3 geology there at the Conroe oil field?</p> <p>4 A It's typically the oil and gas agencies -- not 5 agencies -- oil and gas, you know, work or it's the 6 USGS.</p> <p>7 Can I add a little bit to that?</p> <p>8 Q Please.</p> <p>9 A I mean, in addition to USGS, I mean, it's -- 10 I'm talking about other federal agencies, a lot of 11 times, will commission studies, so...</p> <p>12 Q Okay. Do you know of any specific studies that 13 you relied upon that provided a specific expression or 14 indication of the geologic nature of the lower Cockfield 15 at or around WDW315?</p> <p>16 A I don't remember a specific one at this point, 17 no, sir.</p> <p>18 Q Would you agree or disagree that the majority 19 of the work that was developed from a regional 20 perspective, particularly that included the Conroe oil 21 field, was developed as a result of the exploration for 22 hydrocarbons and the production of hydrocarbons in the 23 Conroe oil field?</p> <p>24 A I -- you know, I'll be honest with you, I don't 25 know exactly how many came from oil and gas exploration</p>	<p style="text-align: right;">396</p> <p>1 together?</p> <p>2 A No, sir.</p> <p>3 Q I'd like to ask you one, perhaps a few, just a 4 few questions -- I'm sorry -- about TexCom Exhibit 5 No. 94. It was the big binder that was just introduced 6 at the tail end of your testimony.</p> <p>7 A Okay.</p> <p>8 Q Specifically, I'd like to turn your attention 9 to the map there at the very front of the exhibit. You 10 may need to pull it out to answer this question, you may 11 not.</p> <p>12 But you have conducted what appears to be 13 research of all artificial penetrations within 4.5 miles 14 of WDW315 that exists north of the EW-4400-S Fault. Is 15 that a fair characterization of this map?</p> <p>16 A Yes, sir, it is.</p> <p>17 Q Okay. Can you help me understand why you 18 picked 4.5 miles as your area of research?</p> <p>19 A You know, we had gone out to 2.94, and in 20 Mr. Grant's information he submitted since then, he was 21 out to 3.3, 3.4, I think. And so we just decided to go 22 ahead and step out even further just to try and cover -- 23 you know, instead of having to keep going out and 24 finding wells in a different radius, we said, "Well, 25 we'll choose four-and-a-half miles, and that should</p>
<p style="text-align: right;">395</p> <p>1 and how many came from other sources.</p> <p>2 Q Fair enough. I think that I understand your 3 testimony to suggest that traditionally, there has not 4 been a great deal of production activity in the Conroe 5 oil field from within the lower Cockfield?</p> <p>6 A I don't think I was talking about production 7 from the lower Cockfield, so...</p> <p>8 Q Okay. Then let me just ask.</p> <p>9 Are you aware of any oil and gas that was 10 discovered in producible quantities in the lower 11 Cockfield within the Conroe oil field?</p> <p>12 A No.</p> <p>13 Q Okay. Mr. Casey, have you and as part of your 14 work on the Class I application for TexCom felt -- well, 15 have you, as part of your work in the application for 16 TexCom, at any point in time provided a corrective 17 action plan for any potential migration pathways that 18 you might or might not -- or that you might have 19 discovered?</p> <p>20 A No, I have not.</p> <p>21 Q Okay. Do you anticipate, based on what you 22 know today -- everything that you know today about the 23 lower Cockfield there at WDW315 and TexCom's proposed 24 operations, do you anticipate based on that world of 25 knowledge of having to put a corrective action plan</p>	<p style="text-align: right;">397</p> <p>1 cover anything that would come up if there was any other 2 questions." So we wanted to make sure we just had all 3 the records available.</p> <p>4 Q So there was no -- there was -- to make sure I 5 understand, there was -- other than just an abundance of 6 caution, there was no other motivating factor that 7 compelled you to look out to specifically 4.5 miles?</p> <p>8 A No, sir. It was strictly just to try and cover 9 any bases that might come up.</p> <p>10 Q Are you aware of Mr. Grant's opinions of the 11 potential cone of influence from the proposed TexCom 12 injection operations based on his review and assessment 13 of your September 2009 pressure fall-off test?</p> <p>14 A Not specifically know which modeling run you're 15 talking about. I mean, I've heard -- you know, I was 16 told about 3.3 was the one he came up with, and beyond 17 that, I have not specifically looked at his data.</p> <p>18 Q Okay. Mr. Casey, I appreciate it.</p> <p>19 MR. HILL: I pass the witness.</p> <p>20 JUDGE WALSTON: Denbury?</p> <p>21 MS. MENDOZA: Yes, thank you.</p> <p>22 RE CROSS-EXAMINATION</p> <p>23 BY MS. MENDOZA:</p> <p>24 Q I'll give you a moment. I don't have any 25 questions about Exhibit 94.</p>

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398	<p>1 A Okay.</p> <p>2 Q So you can put that one away.</p> <p>3 A They need to fold up a little smaller to fit.</p> <p>4 Okay.</p> <p>5 Q Do you still have TexCom Exhibit 11 in front of</p> <p>6 you? That would be the core sampling.</p> <p>7 A Yes, I do.</p> <p>8 Q I believe your testimony is you would have</p> <p>9 ignored the fifth core sample results that are reported</p> <p>10 on Page 146 of TexCom Exhibit 11 because that's shaly?</p> <p>11 A Yes, ma'am.</p> <p>12 Q Did you review the remainder of the core sample</p> <p>13 analysis to determine that it was shaly?</p> <p>14 A Specifically, I'm not sure what you're talking</p> <p>15 about.</p> <p>16 Q You reviewed some data to determine that the</p> <p>17 fifth sample that you were ignoring is actually shaly.</p> <p>18 Is that correct?</p> <p>19 A The permeability leads to the -- infers that it</p> <p>20 has a higher shale content than the other samples.</p> <p>21 Q So you relied solely upon the permeability to</p> <p>22 determine that the fifth sample that you are going to</p> <p>23 ignore is actually shaly. Is that correct?</p> <p>24 A Yes, ma'am.</p> <p>25 Q Would you take a look at Page 135 of TexCom</p>	400	<p>1 And if I am reading this table correct, it says that</p> <p>2 they have thin section petrography, x-rayed diffraction,</p> <p>3 and scanning electron microscope analysis performed on</p> <p>4 that sample. Is that your understanding of this table?</p> <p>5 A Yes, ma'am.</p> <p>6 Q Did you review the thin section petrography on</p> <p>7 that sample?</p> <p>8 A No. We -- you know, in looking at the table</p> <p>9 and in looking at the average, you know, permeability</p> <p>10 versus porosity, it's an outlier. It's significantly</p> <p>11 less, and when you're looking at fluid flow, it's -- you</p> <p>12 know, it's low permeability.</p> <p>13 Q Mr. Casey, my question is very simple.</p> <p>14 Did you review the thin section</p> <p>15 petrography that was run on the sample taken at</p> <p>16 6,082.96 feet?</p> <p>17 A No, I did not.</p> <p>18 Q Did you review the x-ray diffraction that was</p> <p>19 done on the sample that was taken at 6,082.96 feet?</p> <p>20 A Not at this time, no.</p> <p>21 Q Did you review the scanning electron microscopy</p> <p>22 that was done on the sample that was taken at</p> <p>23 6,082.96 feet?</p> <p>24 A No, ma'am.</p> <p>25 Q If that data existed, do you believe that it</p>
399	<p>1 Exhibit 11. You see Table 1 there?</p> <p>2 A Yes, ma'am.</p> <p>3 Q The third line in -- or the fourth line in</p> <p>4 Table 1 has a sample depth of 6082.96. That is the same</p> <p>5 sample depth for the fifth sample that you were</p> <p>6 ignoring. Isn't that correct?</p> <p>7 A Yes, ma'am.</p> <p>8 Q The grain size for the sample from 6082.96 is</p> <p>9 0.15 millimeters. Is that correct?</p> <p>10 A That's correct.</p> <p>11 Q That is a sand, isn't it, Mr. Casey?</p> <p>12 A It could be considered a sand.</p> <p>13 Q Did you look at this data in determining to</p> <p>14 throw out the fifth sample?</p> <p>15 A No. The fifth sample doesn't fit with the</p> <p>16 average of the other four samples. It's an outlier.</p> <p>17 Q Mr. Casey, I understand that that's your</p> <p>18 position, but I think your testimony now is that you did</p> <p>19 not look at the petrography results in determining</p> <p>20 whether you were going to throw out the fifth sample.</p> <p>21 Correct?</p> <p>22 A (Witness reviewing document.) That's correct.</p> <p>23 Q If you could take a look, now, at Page 134 of</p> <p>24 TexCom Exhibit 11. And in the Table 1 there, the fourth</p> <p>25 line is, again, for the same sample depth, 6082.96 feet.</p>	401	<p>1 would be informative in your analysis of the fifth</p> <p>2 sample that you have chosen to throw out?</p> <p>3 A Possibly.</p> <p>4 Q If it existed, would you want to see it?</p> <p>5 A For the analysis I was doing, I didn't feel it</p> <p>6 was necessary.</p> <p>7 Q Do you believe it would provide you with any</p> <p>8 relevant information?</p> <p>9 A It would provide me with information for that</p> <p>10 section, but for looking at overall permeability, it --</p> <p>11 I don't believe it was necessary.</p> <p>12 Q Would it be relevant to determine if you should</p> <p>13 throw out the fifth sample?</p> <p>14 A From a permeability standpoint, no, ma'am.</p> <p>15 Q So you're throwing out the fifth sample because</p> <p>16 it gave you an answer you did not like?</p> <p>17 A No, it was --</p> <p>18 Q Is that correct?</p> <p>19 A I threw out the fifth sample because it was an</p> <p>20 outlier. It didn't fit with the average of the -- of</p> <p>21 the zones chosen.</p> <p>22 Q Could you turn to Page 141 of TexCom</p> <p>23 Exhibit 11?</p> <p>24 A (Witness complying.)</p> <p>25 Q This is the x-ray diffraction data that you did</p>

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402	<p>1 not review. Is that correct?</p> <p>2 A I believe so.</p> <p>3 Q You see the sample that was taken at</p> <p>4 6,082.76 feet?</p> <p>5 A Yes, ma'am.</p> <p>6 Q And this -- the data from this, which is</p> <p>7 reflected across, that shows signs of secondary</p> <p>8 mineralization in a sand. Correct?</p> <p>9 MR. RILEY: I'm sorry. Just for my</p> <p>10 benefit, I heard 6,082.76 feet. So is this a different</p> <p>11 depth than was discussed just a few questions ago?</p> <p>12 Q (BY MS. MENDOZA) Mr. Casey, is this a</p> <p>13 different depth than was discussed a few seconds ago? I</p> <p>14 believe it's probably about .2 feet off.</p> <p>15 A Yes, it is different.</p> <p>16 Q Okay. And so do you think that this sample</p> <p>17 that they're running the x-ray diffraction on is</p> <p>18 different than the sample that you are discounting?</p> <p>19 A It looks like it's a sandy section above where</p> <p>20 the shaly portion started.</p> <p>21 Q So if the depths are not exact, you would say</p> <p>22 it's not part of the same sample?</p> <p>23 A I cannot tell you if it's part of the same</p> <p>24 sample or not, ma'am. It may not be exactly where they</p> <p>25 did their measurement for permeability, and it is a</p>	404	<p>1 sample?</p> <p>2 MR. RILEY: I'm sorry. I apologize. I've</p> <p>3 lost track of what is the same sample. Could counsel be</p> <p>4 more clear as to what sample we're referring to?</p> <p>5 Q (BY MS. MENDOZA) Did you not understand what I</p> <p>6 meant by same sample?</p> <p>7 MR. RILEY: Well, you know, Judges, I have</p> <p>8 an objection, and counsel may choose to withdraw the</p> <p>9 question and rephrase rather than responding to my</p> <p>10 question by asking the witness. It would be my</p> <p>11 suggestion. My objection is that the counsel is not</p> <p>12 being specific in her questions, and if she thinks this</p> <p>13 is important, I think it's important that we be</p> <p>14 specific.</p> <p>15 JUDGE WALSTON: Would you clarify your</p> <p>16 question?</p> <p>17 MS. MENDOZA: I can clarify my question.</p> <p>18 Q (BY MS. MENDOZA) I've asked you to look at the</p> <p>19 sample that was tested on Page 150 of TexCom Exhibit 11</p> <p>20 and the sample that was tested on Page 151 of TexCom</p> <p>21 Exhibit 11. Were those tests run on the same sample?</p> <p>22 A Both samples have the same sample number of</p> <p>23 2-1A and appear to be at the same depth with the same</p> <p>24 permeability to air of 900 millidarcies.</p> <p>25 Q And you talked about the net confining stress</p>
403	<p>1 different depth.</p> <p>2 Q It is a different depth, so you believe that is</p> <p>3 a different sample?</p> <p>4 A As I said, I -- you know, I wasn't there to</p> <p>5 know if it's a different sample or a different part of</p> <p>6 the sample, but it's not the same depth.</p> <p>7 Q Okay. So just talking, then, about the one</p> <p>8 that we were talking about, maybe it's not the same</p> <p>9 depth. Does that one -- does the sample, then, that was</p> <p>10 analyzed by x-ray diffraction at 6,082.76 feet show</p> <p>11 signs of secondary mineralization?</p> <p>12 A I couldn't tell you.</p> <p>13 Q Do you know what secondary mineralization is?</p> <p>14 A I know what the term is, but I'm not a -- I</p> <p>15 don't do lab analysis.</p> <p>16 Q I believe you went over with Mr. Riley the</p> <p>17 permeability versus throughput tables that are on</p> <p>18 Page 150 -- or start on Page 150 of TexCom Exhibit 11.</p> <p>19 If you could, turn to those.</p> <p>20 A Okay.</p> <p>21 Q I believe the first one at Page 150, the net</p> <p>22 confining stress was 300 psi. On Page 151, the net</p> <p>23 confining stress was 2,000 psi.</p> <p>24 A That's correct.</p> <p>25 Q And those were run, you believe, on the same</p>	405	<p>1 with Mr. Riley. So for the sample that is done on</p> <p>2 Page 150, the net confining stress is 300 psi?</p> <p>3 A That's correct.</p> <p>4 Q And the sample that is taken on Page 151, the</p> <p>5 net confining stress is 2,000 psi?</p> <p>6 A That's correct.</p> <p>7 Q And if I understood your testimony, the</p> <p>8 2,000 -- you were looking at the permeability in the</p> <p>9 2,000 psi because that is reflective of the formation.</p> <p>10 Is that correct?</p> <p>11 A It is a close approximation to formation</p> <p>12 stress, yes, ma'am.</p> <p>13 Q What is the formation stress in the lower</p> <p>14 Cockfield?</p> <p>15 A Honestly, I'm not sure.</p> <p>16 Q Are you capable of calculating that?</p> <p>17 A Sitting here, probably not. It's been a few</p> <p>18 years.</p> <p>19 Q You do understand that the confining pressure</p> <p>20 is basically the rock stress or the weight that's on top</p> <p>21 of it?</p> <p>22 A That's correct.</p> <p>23 Q And in the lower Cockfield, we're somewhere</p> <p>24 below 6,000 feet, below the ground surface?</p> <p>25 A That's correct.</p>

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406	<p>1 Q And you would use approximately 1 psi per foot.</p> <p>2 Is that correct?</p> <p>3 A It's been a few years since I've calculated it.</p> <p>4 Q So when you say that 2,000 psi is a rough</p> <p>5 approximation of the lower Cockfield, you actually don't</p> <p>6 have any number for the lower Cockfield to compare that</p> <p>7 to, do you?</p> <p>8 A Off my head -- top of my head, no, ma'am.</p> <p>9 Q Okay. So -- and then, if you were to reduce</p> <p>10 the 6,000 psi that we would get by multiplying</p> <p>11 6,000 feet by 1 psi per foot, you reduce that by the</p> <p>12 pore pressure using the data taken from your fall-off</p> <p>13 test, you're going to get something significantly</p> <p>14 greater than 2,000 psi. Do you know whether you would</p> <p>15 or not?</p> <p>16 MR. RILEY: Objection. I haven't heard</p> <p>17 any discussion of the other terminology and factors in</p> <p>18 the question. It may be that -- maybe I should just be</p> <p>19 quiet and let the witness answer, but I don't know what</p> <p>20 counsel has just asked the witness. She's injected some</p> <p>21 information in her question without establishing a basis</p> <p>22 for it.</p> <p>23 JUDGE WALSTON: Frankly, I forgot exactly</p> <p>24 what the question was so either the court reporter read</p> <p>25 it back or restate it. I'm not sure -- so you're saying</p>	408	<p>1 Sitting here right now, I don't know what the number</p> <p>2 would be.</p> <p>3 Q Did you calculate it, perhaps, before you came</p> <p>4 here?</p> <p>5 A No, I've never calculated it for the lower</p> <p>6 Cockfield.</p> <p>7 Q Did you have a number to which you compared the</p> <p>8 net confining stress shown on Page 151 of TexCom</p> <p>9 Exhibit 11?</p> <p>10 A No. The lab simply --</p> <p>11 Q Excuse me, Mr. Casey.</p> <p>12 A The lab simply added, you know --</p> <p>13 JUDGE WALSTON: Hang on.</p> <p>14 Q (BY MS. MENDOZA) Excuse me, Mr. Casey.</p> <p>15 JUDGE WALSTON: Listen to her question and</p> <p>16 see if you can answer the question.</p> <p>17 Q (BY MS. MENDOZA) Did you have a number to</p> <p>18 which you compared the net confining stress shown on</p> <p>19 Page 151 of TexCom Exhibit 11?</p> <p>20 A I have not calculated the number, no, ma'am.</p> <p>21 Q Do you -- did anybody else calculate that</p> <p>22 number for you?</p> <p>23 A Not that I know of.</p> <p>24 Q Do you have anything that you are comparing the</p> <p>25 2,000 psi net confining stress shown in TexCom</p>
407	<p>1 the question contained information that's not been</p> <p>2 discussed before?</p> <p>3 MR. RILEY: I think when we last left the</p> <p>4 witness, he said something on he hasn't made such a</p> <p>5 calculation in some time, so he could not do a</p> <p>6 calculation on this -- or live, so to speak. He went on</p> <p>7 to say that -- and counsel, then, just asked him, "So if</p> <p>8 we make these several assumptions that it is 1 psi per</p> <p>9 foot 6,000 and then we do some other adjustments, would</p> <p>10 you agree that the number is higher than 2,000" is the</p> <p>11 digest version of what I heard counsel's question to be.</p> <p>12 I don't have any idea what other adjustments counsel</p> <p>13 would like the witness to make or whether those are</p> <p>14 valid in the field of engineering.</p> <p>15 JUDGE WALSTON: I don't remember what the</p> <p>16 question was. If you want to re-ask it or rephrase it.</p> <p>17 MS. MENDOZA: No. After the objection,</p> <p>18 I'm not sure I remember what the question is either.</p> <p>19 JUDGE WALSTON: Okay.</p> <p>20 Q (BY MS. MENDOZA) So I'll talk about this.</p> <p>21 Let's go back and make sure.</p> <p>22 Do you know how to calculate the confining</p> <p>23 pressure in the lower Cockfield?</p> <p>24 A I'm sure, you know, given time and the</p> <p>25 resources, I could calculate the pressure for you.</p>	409	<p>1 Exhibit 11 to when you say it's a rough approximation?</p> <p>2 A It's a lab --</p> <p>3 Q I'm sorry, Mr. Casey. That is not my question.</p> <p>4 MR. RILEY: Well, he didn't -- he got</p> <p>5 "It's a lab" out of his mouth before counsel interrupted</p> <p>6 him.</p> <p>7 MS. MENDOZA: I asked him --</p> <p>8 MR. RILEY: He could have said it's a</p> <p>9 Labrador retriever for all we know, and that would not</p> <p>10 have been responsive.</p> <p>11 JUDGE WALSTON: I think he was diverging</p> <p>12 from the question.</p> <p>13 So do you remember the specific question?</p> <p>14 WITNESS CASEY: Not specifically, no, sir.</p> <p>15 Q (BY MS. MENDOZA) Did you -- do you have any</p> <p>16 number to which you are comparing the net confining</p> <p>17 stress of 2,000 psi shown on Page 151 of TexCom</p> <p>18 Exhibit 11 when you say that it is a rough approximation</p> <p>19 of the lower Cockfield?</p> <p>20 A A specific number? No, ma'am.</p> <p>21 Q Do you have some approximate number?</p> <p>22 A It's at least 2,000, probably higher confining</p> <p>23 stress. The lab uses an estimated confining stress of</p> <p>24 2,000 psi to run the analysis.</p> <p>25 Q Do you know how the lab came up with 2,000 psi?</p>

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<p style="text-align: right;">410</p> <p>1 A I don't know if it was told to them or if it 2 was a number that they could get to with their 3 equipment. 4 Q Do you know how the lab came up with a net 5 confining stress of 2,000 psi? 6 A I was not there when the analysis was done. 7 Q Your answer, then, would be "I have no idea how 8 the lab came up with 2,000 psi." Is that your answer? 9 A I don't know where they got the number from, 10 no, ma'am. 11 Q Okay. Do you know if the lab knew anything 12 about the net confining stress in the lower Cockfield? 13 A It was done before I was involved with the 14 project. No, ma'am. 15 Q Let's go back and compare Page 150 to Page 151 16 of TexCom Exhibit 11. 17 Was it your testimony that as the net 18 confining stress increased, the permeability decreased? 19 A To some degree, yes, there would be a decrease. 20 Q So it would be important to know what the 21 actual net confining stress is in the lower Cockfield if 22 you were going to use this data to make some 23 approximation of the permeability in the lower 24 Cockfield. Correct? 25 A Not necessarily. The -- you know, with the lab</p>	<p style="text-align: right;">412</p> <p>1 And do you normally throw out the high 2 points due -- to take account for the unintentional 3 cracking of the samples when you take them? 4 A I'm not sure what you're getting to, ma'am. 5 Q Okay. I'll go past that one. 6 Mr. Casey, I wanted to ask you now some 7 questions about, I think, a discussion you and Mr. Riley 8 had in your redirect on the mechanical integrity testing 9 that you've done. 10 A Yes. 11 Q And I just had a few questions about that. 12 If I -- 13 A Yes, ma'am. 14 Q If I can show you TexCom Exhibit 20, Page 121. 15 Mr. Casey, do you recognize TexCom 16 Exhibit 20, Page 121? 17 A Yes, I do. 18 Q Okay. And that's a -- the wellbore diagram for 19 WDW410. Is that correct? 20 A That's correct. 21 Q Okay. And I believe that you talked about some 22 testing that was done on the annulus. Is that correct? 23 A That's correct. 24 Q Okay. And I want to make sure that I 25 understand the annulus that you were talking about.</p>
<p style="text-align: right;">411</p> <p>1 data -- 2 Q Excuse me. I think you've answered my question 3 "Not necessarily." 4 I believe your testimony was you don't 5 know if these samples were taken horizontally or 6 vertically through the core. Is that correct? 7 A That's correct. 8 Q Are you familiar with how the core is taken? 9 A In basic terms, yes, ma'am. 10 Q The -- my understanding from reading some of 11 these documents is that they would have liked to have 12 achieved a greater amount of core, but they had trouble 13 achieving more than a 14-foot of core. Is that your 14 understanding? 15 A That's -- I believe that's what it says in the 16 write-up. 17 Q Do you normally analyze core reports like this? 18 A I review them, yes, ma'am. 19 Q Do you analyze them? 20 A For data, we analyze them. We get data from 21 them to use in our work, yes, ma'am. 22 Q You said, "We analyze them." I'm specifically 23 asking: Did you analyze them? 24 A Yes, I have. 25 Q You typically analyze them.</p>	<p style="text-align: right;">413</p> <p>1 I see where you have a tubing, and that is 2 the innermost, sort of, space there. Is that correct? 3 That basically runs from the surface? It looks like it 4 runs down to almost 5,108 feet, or does it run a little 5 bit lower than that? 6 A I believe there's a piece of what they call 7 tailpipe below the packer, so it goes a little bit below 8 where the packer is set, yes, ma'am. 9 Q So it -- so the tubing runs from the surface 10 down to 5,168 feet? 11 A That's correct. 12 Q Okay. And then your packer is set at 13 5,108 feet? 14 A That's correct. 15 Q And then the next line that seems to run all 16 the way from the surface, all the way down to your total 17 depth, what is that? The casing? I'm not sure exactly 18 what you would call it. 19 A Yes, that's what we call long-string casing. 20 Q Long-string casing. And the annulus space that 21 you and Mr. Riley were discussing is the space between 22 the long-string casing and the tubing above the packer. 23 Is that correct? 24 A That's correct. 25 Q Okay. And then from the bottom of the packer</p>

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414	<p>1 to the top of your perforations would be about 937 feet.</p> <p>2 Is that correct? Or maybe I've miscalculated that.</p> <p>3 A That sounds about right.</p> <p>4 JUDGE WALSTON: Could you state it again?</p> <p>5 That's the distance from where to where?</p> <p>6 Q (BY MS. MENDOZA) The distance from -- I'm</p> <p>7 trying to get the distance from the bottom of the packer</p> <p>8 to the top perforation.</p> <p>9 A From the bottom of the packer or the bottom of</p> <p>10 the tailpipe?</p> <p>11 Q Bottom of the packer.</p> <p>12 A I'll make an assumption, the packer is about</p> <p>13 2 feet long, so call it 5110. That's about 935 feet.</p> <p>14 Q And when you ran the test that you and</p> <p>15 Mr. Riley were talking about, you were testing in the</p> <p>16 annulus. Correct?</p> <p>17 A The pressure test portion of the mechanical</p> <p>18 integrity testing was from the top of the packer to</p> <p>19 surface in that annular space between the tubing and the</p> <p>20 casing.</p> <p>21 Q Thank you, Mr. Casey.</p> <p>22 If you could go to Exhibit 6, Page 206. I</p> <p>23 believe you and Mr. Riley were discussing this as well.</p> <p>24 This is your -- part of your modeling data?</p> <p>25 A Yes, ma'am.</p>	416	<p>1 Q Okay. And holding all other things equal, if</p> <p>2 you were to change that boundary condition to an</p> <p>3 infinite-acting outer boundary, you would tend to</p> <p>4 decrease the pressures that you find in your modeling.</p> <p>5 Correct?</p> <p>6 A Correct.</p> <p>7 Q And that would tend to decrease your cone of</p> <p>8 influence. Correct?</p> <p>9 A Correct.</p> <p>10 Q I think I understood your testimony that last</p> <p>11 night, you talked with Dr. Lane about this modeling and</p> <p>12 confirmed that it was a closed outer boundary. Correct?</p> <p>13 A Yes, ma'am.</p> <p>14 Q Okay. So now, looking back on this Page 206 of</p> <p>15 TexCom Exhibit 6, we had some confusion yesterday about</p> <p>16 whether this input file matches the following output</p> <p>17 file. Did you get to talk with Dr. Lane about that and</p> <p>18 try to clear up that confusion?</p> <p>19 A As I said yesterday, this input file is for a</p> <p>20 different modeling run than the output file is. There</p> <p>21 was apparently some -- you know, when it was put</p> <p>22 together, they put the wrong input file with the wrong</p> <p>23 output file.</p> <p>24 Q Okay. So let's go to the output file, and I</p> <p>25 think that begins on Page 210 of Exhibit 6.</p>
415	<p>1 Q I want to make sure we're clear on this.</p> <p>2 Your original model was done -- the</p> <p>3 original model, the model that you introduced as part of</p> <p>4 the application in your last testimony, was done with a</p> <p>5 closed boundary. Is that correct?</p> <p>6 A Yes. All of our modeling is done with --</p> <p>7 Q I'm sorry.</p> <p>8 A Okay. That's fine.</p> <p>9 Q I understand -- I'm going to clarify.</p> <p>10 When I'm talking about the boundaries, I</p> <p>11 understand you modeled a ten-by-ten block, a</p> <p>12 ten-mile-by-ten-mile block. Is that correct?</p> <p>13 A Yes, ma'am.</p> <p>14 Q Okay. And when I'm talking about the boundary,</p> <p>15 I'm talking about the edges of that ten-by-ten block.</p> <p>16 I'm not talking about putting a boundary at a fault or</p> <p>17 something like that.</p> <p>18 A Okay.</p> <p>19 Q So with that understanding that "boundary"</p> <p>20 means at the edges of the ten-by-ten block --</p> <p>21 ten-by-ten-mile block that you modeled, your original</p> <p>22 modeling that you put in the application that was part</p> <p>23 of your testimony in the original hearing, that was done</p> <p>24 with a closed boundary. Correct?</p> <p>25 A That's correct.</p>	417	<p>1 I had asked you yesterday on Page 213 of</p> <p>2 Exhibit 6, midway down the page, there is a notation</p> <p>3 there. Talked about porosity node modifications. Did</p> <p>4 you have an opportunity to ask Dr. Lane what that is?</p> <p>5 A I didn't specifically talk to him about it, no,</p> <p>6 ma'am.</p> <p>7 Q Do you -- sitting here today, do you understand</p> <p>8 what porosity node modifications means as it's used here</p> <p>9 on Page 213 of TexCom Exhibit 6?</p> <p>10 A I kind of understand it, but I'm -- you know, I</p> <p>11 haven't spent any time with Dr. Lane to really get a</p> <p>12 good understanding of what those various terms mean.</p> <p>13 Q I understand this to be in some way an</p> <p>14 indication of what permeability you used in your outside</p> <p>15 grid blocks in your model. Is -- am I close?</p> <p>16 MR. RILEY: Objection, only because of --</p> <p>17 Q (BY MS. MENDOZA) I'm sorry. It was porosity</p> <p>18 that you used.</p> <p>19 MR. RILEY: That's what I was objecting</p> <p>20 to. Sorry.</p> <p>21 Q (BY MS. MENDOZA) I'm sorry. Porosity. I --</p> <p>22 the porosity that you used in the outside grid blocks of</p> <p>23 your model. Is that, perhaps, your understanding?</p> <p>24 A Possibly. I mean, like I said, I'm not -- you</p> <p>25 know, this isn't my area of expertise of knowing exactly</p>

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418	<p>1 what this printout says.</p> <p>2 Q Okay. Did you give Dr. Lane, when you</p> <p>3 initially did this model, a porosity value for the -- to</p> <p>4 be used for the outside grid blocks in your model?</p> <p>5 A I didn't give him a specific number, no, ma'am.</p> <p>6 Q So if I wanted to know how he came up with the</p> <p>7 porosity number to be used in the outside grid blocks of</p> <p>8 that model, I would need to ask Dr. Lane?</p> <p>9 A Yes, ma'am.</p> <p>10 Q Okay. I -- in your discussions with Mr. Hill,</p> <p>11 I heard you mention well correlation. Did you do the --</p> <p>12 or well log correlation. Is well log correlation the</p> <p>13 right term?</p> <p>14 A I'm not exactly sure what you're trying to get</p> <p>15 to.</p> <p>16 Q Well, I -- you were talking about "Did you</p> <p>17 manage to hit the sands when you perforated?" Did you</p> <p>18 remember that discussion?</p> <p>19 A Yes.</p> <p>20 Q And you seemed to express some thought that,</p> <p>21 perhaps, some sands were missed because maybe your</p> <p>22 depths were off.</p> <p>23 A Well, I haven't gone back and analyzed any logs</p> <p>24 that may have been taken after. You know, we did the</p> <p>25 perforating, then we did the injection test. So, you</p>	420	<p>1 Q (BY MS. MENDOZA) When you looked at the well</p> <p>2 logs that you have used here to evaluate the cone of</p> <p>3 influence and I think you said somewhat beyond, perhaps,</p> <p>4 the cone of influence, you went and pulled more</p> <p>5 information from the Railroad Commission? Or somebody</p> <p>6 went and pulled more information from the Railroad</p> <p>7 Commission.</p> <p>8 A You mention well logs.</p> <p>9 Q I'm sorry. Not well logs. Perhaps it's the --</p> <p>10 MR. RILEY: Well records? Is that --</p> <p>11 Q (BY MS. MENDOZA) Yeah, the well records.</p> <p>12 MS. MENDOZA: Thank you.</p> <p>13 Q (BY MS. MENDOZA) Well records that you pulled</p> <p>14 from the Railroad Commission?</p> <p>15 A Yes, we pulled additional well records.</p> <p>16 Q Did you take a look at who the operator was on</p> <p>17 those various well records?</p> <p>18 A The operators at the time the wells were</p> <p>19 drilled or when the information was gathered on the</p> <p>20 wells is listed in the table.</p> <p>21 Q I see more, certainly, than one operator here.</p> <p>22 Do you --</p> <p>23 JUDGE WALSTON: Just for the record,</p> <p>24 you're looking at Exhibit 94.</p> <p>25 MS. MENDOZA: I'm sorry. I'm looking at</p>
419	<p>1 know, I haven't gone to look to see if you correlate the</p> <p>2 original logs on a well with -- you know, with the</p> <p>3 testing you're doing right then, whether they might have</p> <p>4 been a little off on their number. We -- you know, we</p> <p>5 specified the depths for them to perforate, and that's</p> <p>6 the depth that they have said they perforated. But I</p> <p>7 haven't gone back and specifically looked at the logs to</p> <p>8 see if maybe they were off a half a foot or a foot, you</p> <p>9 know.</p> <p>10 Q So your depth control may not have been exact?</p> <p>11 A It's -- unfortunately, with logging equipment,</p> <p>12 sometimes they're a little -- you know, you can be --</p> <p>13 due to line stretch or other issues with the equipment,</p> <p>14 you could, you know, be off on -- after doing multiple</p> <p>15 runs into the same well.</p> <p>16 Q So your depth control may not have been exact?</p> <p>17 A Yes, ma'am.</p> <p>18 Q Okay. I remember some discussion yesterday</p> <p>19 about the operators in the Conroe oil field.</p> <p>20 You're aware that Denbury is the --</p> <p>21 MR. RILEY: Objection. The lead-in alone</p> <p>22 indicates that it's beyond the scope of redirect.</p> <p>23 JUDGE WALSTON: Well, let's hear her</p> <p>24 question first.</p> <p>25 MR. RILEY: Okay.</p>	421	<p>1 Exhibit 94, the document within Exhibit 94 that is</p> <p>2 APP1009902. I think it's the first page after the map.</p> <p>3 A Yes, there's more than one operator, and those</p> <p>4 wells are not located within the Conroe field.</p> <p>5 Q (BY MS. MENDOZA) Okay. So this is stretching</p> <p>6 you outside the Conroe field?</p> <p>7 A Yes, you're outside the Conroe field.</p> <p>8 Q Okay. And within the Conroe field, did you</p> <p>9 pull similar records?</p> <p>10 A Yes, ma'am.</p> <p>11 Q Okay. And did those show all -- just a single</p> <p>12 operator?</p> <p>13 A No. Back -- you know, there were a number of</p> <p>14 people who drilled wells there.</p> <p>15 Q And if we looked at page -- I think it's</p> <p>16 exhibit -- is it 88 of your prefiled testimony? This</p> <p>17 also is an area of review well list. Is that correct?</p> <p>18 A Exhibit 88?</p> <p>19 Q 88, Exhibit 88, TexCom Exhibit 88. And I</p> <p>20 believe it's entitled, "Area of Review Well List."</p> <p>21 A Yes, ma'am.</p> <p>22 Q And the fifth column over from the left</p> <p>23 indicates the operator names.</p> <p>24 A Yes, ma'am.</p> <p>25 Q And there are a number of operators listed</p>

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422	<p>1 there.</p> <p>2 A Yes, there is.</p> <p>3 Q Have you counted to see how many different</p> <p>4 operators have operated within the Conroe oil field?</p> <p>5 A No, ma'am.</p> <p>6 Q In modeling that you have performed between the</p> <p>7 first remand and this -- before -- between the first</p> <p>8 hearing and this hearing, you performed modeling that</p> <p>9 changed the permeability or the transmissivity across</p> <p>10 the 4400 South Fault. Is that correct?</p> <p>11 A That's correct.</p> <p>12 Q Okay. And initially, you had said that the</p> <p>13 4400 South Fault was -- I guess there was -- there was</p> <p>14 permeability across that fault. Is that correct?</p> <p>15 A Yes, ma'am.</p> <p>16 Q Okay. And is there horizontal permeability</p> <p>17 parallel to that fault? Do you understand what I mean</p> <p>18 by -- in what direction I'm talking?</p> <p>19 A No, ma'am.</p> <p>20 Q Okay. If that -- let's say the wall there, the</p> <p>21 windows there are the fault. When we're talking about</p> <p>22 across the fault, we're talking about fluid would come</p> <p>23 up to the fault and go through it and go outside the</p> <p>24 building, and that's -- when I say "across," is that</p> <p>25 your understanding?</p>	424	<p>1 MS. MENDOZA: We pass the witness.</p> <p>2 JUDGE WALSTON: Okay. The individual</p> <p>3 protestants?</p> <p>4 MR. FORSBERG: I think I have a few</p> <p>5 questions.</p> <p>6 RECROSS-EXAMINATION</p> <p>7 BY MR. FORSBERG:</p> <p>8 Q Mr. Casey, I believe Mr. Riley had asked you a</p> <p>9 few questions with regards to the injection of</p> <p>10 350 gallons per minute as the maximum injection into the</p> <p>11 well?</p> <p>12 A Yes, sir.</p> <p>13 Q So the 350 -- just for my understanding, the</p> <p>14 350 gallons per minute can be achieved with one well.</p> <p>15 Correct?</p> <p>16 A Yes, sir. The way the permit is written, it's</p> <p>17 300 -- the maximum at any well is 350 gallons a minute,</p> <p>18 but the site maximum is also 350 gallons a minute.</p> <p>19 Q But the first well can achieve that maximum?</p> <p>20 A Yes.</p> <p>21 THE REPORTER: I'm sorry. Did you say</p> <p>22 "can"?</p> <p>23 MR. FORSBERG: Can achieve that maximum.</p> <p>24 Q (BY MR. FORSBERG) Did you understand that I</p> <p>25 said "can"?</p>
423	<p>1 A Yes, it would --</p> <p>2 Q Okay.</p> <p>3 A -- pass the fault in a horizontal direction.</p> <p>4 Q Okay. And then I am -- I'm talking about now</p> <p>5 horizontal permeability may be parallel to the fault.</p> <p>6 So when fluid comes up to the fault, does fluid then</p> <p>7 move, say, along the fault? That would be along the</p> <p>8 wall.</p> <p>9 A I don't believe so, no, ma'am.</p> <p>10 Q Okay. Have you done any testing to confirm</p> <p>11 that?</p> <p>12 A No, ma'am.</p> <p>13 Q Okay. And then is there vertical permeability</p> <p>14 at the 4400 Fault?</p> <p>15 A I do not believe so, no, ma'am.</p> <p>16 Q Okay. And by "vertical," you understand that I</p> <p>17 mean that the fluid would come up to the fault and then</p> <p>18 go up the fault, up the wall, basically, to the next</p> <p>19 floor above us?</p> <p>20 A Correct. That is what vertical permeability</p> <p>21 is.</p> <p>22 Q Have you done any testing to see if the 4400</p> <p>23 South Fault is vertically permeable?</p> <p>24 A No, ma'am.</p> <p>25 Q Okay.</p>	425	<p>1 A Yes, I did.</p> <p>2 Q Do you have any understanding, then, what is</p> <p>3 the need for the additional three wells?</p> <p>4 A Well, as a -- as an operator, you know, with</p> <p>5 which you're business is to, you know, take waste in and</p> <p>6 inject into the ground, if you have a well issue such as</p> <p>7 your -- you know, the well gets clogged, the perforation</p> <p>8 gets clogged and you're not able to inject, you have to</p> <p>9 take the well -- you know, notify TCEQ, do a workover on</p> <p>10 the well to, let's say, do a cleanout or an acidation</p> <p>11 job, while you're shut down, you would like to have the</p> <p>12 ability to inject into another well while you're working</p> <p>13 on the well in question. So most operators would</p> <p>14 typically want to have at least two wells as backup</p> <p>15 capacity should you have injection issues with your</p> <p>16 first well.</p> <p>17 Q Is it customary in the industry to have three</p> <p>18 backup wells?</p> <p>19 A No. Typically, due to the length of time to</p> <p>20 permit a Class I injection well, most operators will</p> <p>21 permit two or three additional well sites for the</p> <p>22 intention of should, you know, something catastrophic</p> <p>23 happen with an existing injection well, such as it gets</p> <p>24 plugged and you cannot get it to take water at any point</p> <p>25 and you have to plug that well, you have a permit</p>

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426	<p>1 available to you to drill another backup well.</p> <p>2 Q Do you have any opinion as to whether the</p> <p>3 public interest is served by having four wells at the</p> <p>4 TexCom facility as opposed to just one or two?</p> <p>5 A From a public interest standpoint, I mean, if</p> <p>6 they're taking waste in, they need to have the ability</p> <p>7 to inject the waste into the ground. And so by having</p> <p>8 additional permits available, they can continue</p> <p>9 operation and --</p> <p>10 Q Okay. Do you have an opinion as to whether or</p> <p>11 not the public interest is served by having four wells</p> <p>12 as opposed to one or two?</p> <p>13 MR. RILEY: Objection. Counsel</p> <p>14 interrupted. It's not a yes-or-no question. He was</p> <p>15 expressing his opinion.</p> <p>16 Q (BY MR. FORSBURG) Yes or no, do you have an</p> <p>17 opinion?</p> <p>18 MR. RILEY: Okay. Is that the answer he</p> <p>19 wants, does he have an opinion? Okay, nevermind.</p> <p>20 A Can you restate the question? Sorry.</p> <p>21 Q (BY MR. FORSBURG) Yes.</p> <p>22 Do you have an opinion as to whether the</p> <p>23 public interest is served by the TexCom facility having</p> <p>24 four wells as opposed to just one or two?</p> <p>25 A Yes.</p>	428	<p>1 you did that.</p> <p>2 Q (BY MR. FORSBURG) All right. And we know that</p> <p>3 no one would ever violate a permit issue by TCEQ.</p> <p>4 Right?</p> <p>5 MR. RILEY: Objection. That's -- can't be</p> <p>6 a real question.</p> <p>7 MR. FORSBURG: It is a real question.</p> <p>8 MR. RILEY: Okay. Well, I still object,</p> <p>9 then.</p> <p>10 JUDGE WALSTON: What's your objection?</p> <p>11 MR. RILEY: Calls for speculation.</p> <p>12 JUDGE WALSTON: I'll overrule that</p> <p>13 objection.</p> <p>14 A Say your question again, so I make sure I'm</p> <p>15 answering the correct question.</p> <p>16 MR. FORSBURG: Can the court reporter</p> <p>17 restate it, please.</p> <p>18 (The record was read as requested)</p> <p>19 A That, I don't know.</p> <p>20 Q (BY MR. FORSBURG) Have you ever violated a</p> <p>21 permit issued by TCEQ?</p> <p>22 A Not willingly, no.</p> <p>23 Q How about unwillingly?</p> <p>24 A You know, it's potential that I might have at</p> <p>25 some point an not realized it.</p>
427	<p>1 Q Now, when did you form this opinion?</p> <p>2 A As to when, I mean, it's -- it could be when I</p> <p>3 started working for TexCom and I suggested permitting</p> <p>4 four wells -- three additional wells.</p> <p>5 Q (BY MR. FORSBURG) Putting the maximum of 350</p> <p>6 within the permit aside, the 350 gallons per minute</p> <p>7 aside, what is the maximum number of gallons per minute</p> <p>8 that the four wells would be capable of injecting?</p> <p>9 A They're limited by their permit. They can't --</p> <p>10 Q Well, I said putting the permit aside, what is</p> <p>11 their structural or what is their mechanical capability</p> <p>12 of injection?</p> <p>13 JUDGE WALSTON: I assume you're asking if</p> <p>14 you had four wells in operation at the same time.</p> <p>15 MR. FORSBURG: Correct.</p> <p>16 JUDGE WALSTON: Okay.</p> <p>17 A I mean, they're designed for, you know, at a</p> <p>18 minimum 350 gallons per minute each is how they're</p> <p>19 designed. Physically, they can probably take</p> <p>20 considerably more water than that. It just depends on,</p> <p>21 you know, how they're operating at the time of use.</p> <p>22 But like we said, they're limited by their</p> <p>23 permit. So you can't physically inject into all four</p> <p>24 wells at 350 gallons a minute unless -- you know, you'd</p> <p>25 be in significant violation of your permit conditions if</p>	429	<p>1 Q What would you call the issue with the Class V</p> <p>2 permit and the injection viscosity?</p> <p>3 A I missed the viscosity number in the -- you</p> <p>4 know, in the intent. You know, if -- you know, if I had</p> <p>5 caught the number during -- you know, when we were</p> <p>6 putting together the program, I would have clarified it</p> <p>7 with TCEQ because I don't believe that was their intent</p> <p>8 for the testing. The numbers they put into the --</p> <p>9 MR. FORSBURG: I'm going to object.</p> <p>10 A -- class V --</p> <p>11 MR. FORSBURG: This is unresponsive to</p> <p>12 anything. He's speculating about the intent of TCEQ.</p> <p>13 MR. RILEY: You asked him to speculate.</p> <p>14 JUDGE WALSTON: I forgot what the question</p> <p>15 was, though.</p> <p>16 MR. RILEY: Okay.</p> <p>17 MR. FORSBURG: Just had him speculating</p> <p>18 what TCEQ has to say. That's not responsive to any</p> <p>19 question, plus he's clearly just speculating about what</p> <p>20 TCEQ --</p> <p>21 JUDGE WALSTON: Well, that may have been</p> <p>22 what the answer called -- question called for. I don't</p> <p>23 know. I can't remember what the question was. But</p> <p>24 anyway, go ahead and move to your next question.</p> <p>25 Q (BY MR. FORSBURG) Did you violate the Class V</p>

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430	<p>1 permit issued by TCEQ in regards to the TexCom --</p> <p>2 MR. RILEY: Objection.</p> <p>3 Q (BY MR. FORSBERG) -- facility testing?</p> <p>4 MR. RILEY: Now, violations are determined</p> <p>5 by the TCEQ, so he's asking now for the witness to</p> <p>6 speculate as to what TCEQ might determine to be a</p> <p>7 violation of the Class V permit.</p> <p>8 JUDGE WALSTON: Let me ask you this: How</p> <p>9 is this directed to what the redirect examination was as</p> <p>10 well? I think you're getting far afield of the redirect</p> <p>11 examination. I think the ALJs are aware that on</p> <p>12 occasion, people violate orders or permits.</p> <p>13 MR. FORSBERG: Well, I understand. But I</p> <p>14 mean, I think it's an important point when their only</p> <p>15 expert being offered on remand on these issues is having</p> <p>16 himself admitted violation, and now he can't -- I think</p> <p>17 it's --</p> <p>18 JUDGE WALSTON: But at this point, I think</p> <p>19 you're well beyond the scope of redirect.</p> <p>20 MR. FORSBERG: Okay. I'll move on, Your</p> <p>21 Honor.</p> <p>22 Q (BY MR. FORSBERG) If you could turn back to</p> <p>23 the Exhibit 94 that we've been talking about a bit</p> <p>24 today. Do you have that in front of you?</p> <p>25 A Yes, I do.</p>	432	<p>1 Q Where is the cement plug located on Well E038?</p> <p>2 A According to the paperwork, it looks like at a</p> <p>3 1,050 feet and then at the surface.</p> <p>4 Q Based upon your experience, is that the correct</p> <p>5 location of the cement plug?</p> <p>6 A It's below the freshwater identified in that</p> <p>7 area at that time.</p> <p>8 Q And what you basing that opinion on?</p> <p>9 A Because the dates in which these wells were</p> <p>10 drilled back in the '50s, freshwater was typically less</p> <p>11 than a thousand feet.</p> <p>12 Q I believe you testified yesterday that the</p> <p>13 cement plug should be located where?</p> <p>14 A As in reference to what? I guess --</p> <p>15 Q In a plugged well, where should a cement plug</p> <p>16 be located in reference to drinking water, or an</p> <p>17 underground source of drinking water?</p> <p>18 A At the base of the freshwater.</p> <p>19 Q As we know it today, is 919 feet to 1,050 feet,</p> <p>20 is that below the underground source of drinking water?</p> <p>21 A Yes, it is.</p> <p>22 Q And what do you base that opinion on?</p> <p>23 A Well, in our application, we've -- you know, to</p> <p>24 be conservative, we've taken the freshwater down to the</p> <p>25 top of Jackson shale even though the lower aquifer, I</p>
431	<p>1 Q Okay. If you could look at the page marked</p> <p>2 APP1009902.</p> <p>3 A Yes, sir.</p> <p>4 Q That's the chart, I guess, that was formulated,</p> <p>5 the summary of the additional well records?</p> <p>6 A Yes, sir.</p> <p>7 Q If you take Well E038, for example, you show a</p> <p>8 depth of 6,443 feet. Is that correct?</p> <p>9 A That's correct.</p> <p>10 Q Would you agree with me that that is a well</p> <p>11 that drills through all three levels -- all three</p> <p>12 layers --</p> <p>13 I'm forgetting my terminology.</p> <p>14 JUDGE EGAN: The lower, middle, and upper.</p> <p>15 Q (BY MR. FORSBERG) -- of the Cockfield?</p> <p>16 MR. FORSBERG: Thank you, Your Honor.</p> <p>17 A Potentially, yes.</p> <p>18 Q (BY MR. FORSBERG) How is it potentially?</p> <p>19 A I don't know the geology out at that distance</p> <p>20 myself, personally.</p> <p>21 Q Okay. Based upon your best reasonable</p> <p>22 estimate, is that -- is 6,443 feet into the lower</p> <p>23 Cockfield at least drilled into the lower Cockfield?</p> <p>24 A If the depths are similar, yes, it would be</p> <p>25 into lower Cockfield.</p>	433	<p>1 believe it's the Catahoula. It shows to be around</p> <p>2 10,000 TDS which would make it technically a USDW, but</p> <p>3 that zone is currently being used as an injection zone</p> <p>4 by Denbury for their oil and gas waste.</p> <p>5 Q How deep does the Gulf Coast aquifer system</p> <p>6 reach?</p> <p>7 A Off the top of my head, I'm not sure.</p> <p>8 Q If the record showed approximately 1525 feet,</p> <p>9 would that surprise you?</p> <p>10 A No, that sounds somewhat correct.</p> <p>11 Q Okay. Well, if the cement plug in E038 is 919</p> <p>12 to 1,050 feet, isn't that within the Gulf Coast Aquifer</p> <p>13 system?</p> <p>14 A It is, but in addition to the --</p> <p>15 Q Thank you. That was the answer to my --</p> <p>16 A -- cement plug, there's also mud.</p> <p>17 Q -- question.</p> <p>18 JUDGE WALSTON: Just answer his question.</p> <p>19 Q (BY MR. FORSBERG) Now, it looks like a number</p> <p>20 of these wells on the Page APP1009902, the plugging</p> <p>21 status on many of them is just "unknown"?</p> <p>22 A That's correct.</p> <p>23 Q It doesn't serve any concern to you that we</p> <p>24 just don't know whether or not they're plugged or at</p> <p>25 what depth they're plugged?</p>

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434	<p>1 A Well, the unknown wells are -- show to be</p> <p>2 completed in the upper Cockfield.</p> <p>3 Q But you have no depth for those completions?</p> <p>4 A No. They have depths for each. Each zone on</p> <p>5 the wells, there's depths listed.</p> <p>6 Q Okay. But for the plugging, you have no -- I</p> <p>7 mean, they say "unknown" for plugging depth.</p> <p>8 A Right. But they're completed in the upper</p> <p>9 Cockfield, so they're not a concern with injection in</p> <p>10 the lower Cockfield.</p> <p>11 Q Okay. What about Well E031? Shows a depth of</p> <p>12 11,800 feet with an unknown plugging status. Does that</p> <p>13 not go -- can we certainly agree that that goes through</p> <p>14 the lower, middle, and upper Cockfield Formations?</p> <p>15 A 031. That well has casing down to 11,000 feet,</p> <p>16 so it's cased through the lower Cockfield.</p> <p>17 Q Okay. Do we know what the structural integrity</p> <p>18 of the casing is?</p> <p>19 A No, sir.</p> <p>20 Q Even with casing, is it not proper in your</p> <p>21 field to have a cement plug in the well somewhere, at</p> <p>22 least?</p> <p>23 A Well, there's an indication on one of the</p> <p>24 documents that the well is to be plugged, but, you know,</p> <p>25 the documents are not in here as far as, you know, the</p>	436	<p>1 A The only indication of this well was on a old</p> <p>2 cloth map that one -- you know, Railroad Commission will</p> <p>3 not let you touch it. You know, you can look at it, but</p> <p>4 you can't touch it. You can't take pictures of it.</p> <p>5 There's no indication whether it was ever actually</p> <p>6 drilled. It is just listed as a well and as a depth,</p> <p>7 and in discussions with Railroad Commission and running</p> <p>8 through all the records they have on the area, it does</p> <p>9 not show up on any other information.</p> <p>10 So the indication we got from the Railroad</p> <p>11 Commission, that it likely was never drilled.</p> <p>12 Especially in 1920 to 12,000, that's a pretty good trick</p> <p>13 with, you know, cable touring. Not impossible, but...</p> <p>14 Q But as you sit here today, you agree that it's</p> <p>15 unknown?</p> <p>16 A Correct.</p> <p>17 Q If you look at Wells E006 and E007, you have</p> <p>18 those just marked as "proposed." Do we know that those</p> <p>19 were not drilled, or is that just a summation that</p> <p>20 you've made?</p> <p>21 A All we have is an application to drill, but</p> <p>22 within the -- and the reason they're combined is there's</p> <p>23 a resubmittal to change the surface location, so they</p> <p>24 moved it, you know, apparently a little bit to one side.</p> <p>25 But within the application to drill is an application to</p>
435	<p>1 well record was never updated with the plugging. At the</p> <p>2 date of plugging, most likely they did put cement in it.</p> <p>3 But like I said, it's cased through the lower Cockfield,</p> <p>4 so it's --</p> <p>5 JUDGE EGAN: The question was, though,</p> <p>6 even with casing, is cement plugging --</p> <p>7 JUDGE WALSTON: Typical.</p> <p>8 JUDGE EGAN: -- typical?</p> <p>9 A Yes, with casing, you know, cement -- use of</p> <p>10 cement plugs is a typical way of plugging, especially up</p> <p>11 into the -- this is the '50s. In typical plugging of</p> <p>12 wells, they would use cement plugs, and in some cases,</p> <p>13 even mechanical plugs.</p> <p>14 Q (BY MR. FORSBERG) And this chart that you</p> <p>15 approved, you wrote that the plugging is -- plugging</p> <p>16 status is unknown?</p> <p>17 A Right, the final status --</p> <p>18 Q Okay. That was --</p> <p>19 A -- is unknown. That's correct.</p> <p>20 Q On Well E030, refers to -- you have a total</p> <p>21 depth as "unknown;" but if I turn to the page that is</p> <p>22 inputted, it talks about a depth of 12,000 feet.</p> <p>23 A Correct.</p> <p>24 Q Why is there a difference between the page on</p> <p>25 E030 and the total depth on your chart?</p>	437	<p>1 drill directionally, and it says that the target will be</p> <p>2 hit at 4900 feet true vertical depth will remain to</p> <p>3 total depth of the well.</p> <p>4 So although it's listed as 6000-plus feet,</p> <p>5 it actually went to 4900 feet, then went horizontally.</p> <p>6 So it never even reached into the, you know, upper</p> <p>7 Cockfield.</p> <p>8 Q And if you would look at -- with me at Well</p> <p>9 E035, you show a total depth of 5,632 feet. Does that</p> <p>10 sound right?</p> <p>11 JUDGE EGAN: Which one? I'm sorry.</p> <p>12 MR. FORSBERG: E035.</p> <p>13 JUDGE EGAN: Thank you.</p> <p>14 A I see where it says that in the table.</p> <p>15 Q (BY MR. FORSBERG) And the table also shows a</p> <p>16 cement packing at -- or cement plug -- excuse me -- at</p> <p>17 400 to 500 feet. Is that correct?</p> <p>18 A That's correct.</p> <p>19 Q Is that a proper location for that cement plug?</p> <p>20 A To the best of my knowledge. That well appears</p> <p>21 to be completed into the upper Cockfield, so...</p> <p>22 Q How do you -- well --</p> <p>23 JUDGE EGAN: I didn't understand.</p> <p>24 Q (BY MR. FORSBERG) The question was: Is the</p> <p>25 cement plug at 400 to 500 feet the proper location, in</p>

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<p>1 your opinion, for the cement plug?</p> <p>2 A Oh, I misunderstood you. I thought the proper</p> <p>3 location as --</p> <p>4 Q No, that's all right.</p> <p>5 A -- the table says.</p> <p>6 Q Okay.</p> <p>7 A And as in proper for plugging? Or I'm a little</p> <p>8 confused on exactly what you asked, sir.</p> <p>9 Q Well, I mean, we've talked about that there is</p> <p>10 a location where cement plugs should be located to</p> <p>11 protect underground sources of drinking water. Correct?</p> <p>12 A Correct.</p> <p>13 Q Based upon what you know and what we've talked</p> <p>14 about, is 400 to 500 feet a proper location for the</p> <p>15 cement plug at Well E035?</p> <p>16 A No. No, it's above the base of the USDW.</p> <p>17 Q And what is your basis that that well is</p> <p>18 completed into the upper Cockfield?</p> <p>19 A Just based on the depth of 5600 feet.</p> <p>20 Q If the record would show that the -- that</p> <p>21 that's actually the -- 5632 is the middle Cockfield --</p> <p>22 A It could --</p> <p>23 Q -- would you dispute that?</p> <p>24 A It could be the middle. I mean, I'm not</p> <p>25 disputing that. At that distance from our site, I</p>	<p>1 not concerned about them.</p> <p>2 Q But the fact that the plugging status on</p> <p>3 several of them is unknown, that we don't even know</p> <p>4 whether some exist or not -- and I'm referring to the</p> <p>5 wells in Exhibit 94 -- that still doesn't cause you to</p> <p>6 have any concern about these wells?</p> <p>7 A No, sir.</p> <p>8 MR. FORSBERG: That's all I have at this</p> <p>9 point. Pass the witness, Your Honor.</p> <p>10 JUDGE WALSTON: Okay. Mr. Walker, we seem</p> <p>11 to always hit you right at the break or the end of the</p> <p>12 day. Do you have very much?</p> <p>13 MR. WALKER: I think I just have a</p> <p>14 question or two, Your Honor.</p> <p>15 JUDGE WALSTON: Okay. Why don't you go</p> <p>16 ahead.</p> <p>17 MR. WALKER: And I'll try and be brief.</p> <p>18 RECROSS-EXAMINATION</p> <p>19 BY MR. WALKER:</p> <p>20 Q Mr. Casey, you previously were testifying about</p> <p>21 the five core samples that, I guess, you looked at or</p> <p>22 looked at the data. Do you recall that?</p> <p>23 A Yes, sir.</p> <p>24 Q And one of those core samples, I believe, you</p> <p>25 testified that you threw out as being an outlier because</p>
439	441
<p>1 couldn't tell you the exact depths of the upper, lower,</p> <p>2 and middle Cockfield.</p> <p>3 Q I think Mr. Riley asked you a general question</p> <p>4 as to whether any of these wells in Exhibit 94 cause you</p> <p>5 any concern, and I believe your answer was no.</p> <p>6 A Yes, sir.</p> <p>7 Q Okay.</p> <p>8 A That's correct.</p> <p>9 Q Why is it that none of these wells cause you</p> <p>10 any concern? Is it just that they're -- you think</p> <p>11 they're too far away from the TexCom facility?</p> <p>12 A Yes. They're outside of our cone of influence.</p> <p>13 Q Is there any other reason why you don't think</p> <p>14 these wells cause any concern?</p> <p>15 A Between them being -- you know, most of them</p> <p>16 being completed in the upper Cockfield, casing through</p> <p>17 the zone, and borehole closure, they just don't pose a</p> <p>18 concern to me for...</p> <p>19 Q So the fact that some of them may not be</p> <p>20 plugged or that we don't know the plugging status, that</p> <p>21 doesn't affect your opinion in any way?</p> <p>22 A Like I said, most of them are completed in the</p> <p>23 upper Cockfield based on depth, and -- you know, and</p> <p>24 with borehole closure, I'm just not concerned. You</p> <p>25 know, they're outside of our cone of influence, so I'm</p>	<p>1 of the extremely low permeability rating as compared to</p> <p>2 the other four. Is that correct?</p> <p>3 A That's correct.</p> <p>4 Q Just briefly, if you can, what did you do with</p> <p>5 the permeability ratings of the other four? Did you</p> <p>6 look at them to average them to give you some kind of</p> <p>7 information?</p> <p>8 A It basically -- like the chart shows, we drew</p> <p>9 the slope of our line based on, you know, an average of</p> <p>10 the four and then -- you know, then you have a line on</p> <p>11 that chart with which to read the various permeability</p> <p>12 ratio numbers.</p> <p>13 Q Okay. Had you included the fifth sample in</p> <p>14 your calculation, what would it have done to your</p> <p>15 result?</p> <p>16 A It would have made it lower, as was discussed</p> <p>17 yesterday, day before yesterday, whenever it was.</p> <p>18 Q If you don't mind, how much lower?</p> <p>19 Significantly lower?</p> <p>20 A Top of my head. Hold on a second. Let me -- I</p> <p>21 don't remember which one. It's in here.</p> <p>22 If you use the existing line on the graph,</p> <p>23 which I don't agree with, but if you use that line and</p> <p>24 take the low porosity of 24 percent, I think we came up</p> <p>25 with around 73 to 74 millidarcies.</p>

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442	<p>1 Q All right. And if you included the fifth</p> <p>2 sample?</p> <p>3 A Oh, sorry, that was with the fifth sample.</p> <p>4 Q I'm sorry.</p> <p>5 Okay. And without that fifth sample, what</p> <p>6 is the millidarcy rating?</p> <p>7 A At the same porosity percentage, which is low</p> <p>8 compared to what the samples show because the average</p> <p>9 for the samples was higher than 24 percent. So at</p> <p>10 24 percent, it would be around 200 millidarcies. If you</p> <p>11 increased the porosity to an average of those four</p> <p>12 samples, be up around 20 -- I'm going to say 29 percent</p> <p>13 porosity. That'd give you approximately, let's say, 480</p> <p>14 millidarcies.</p> <p>15 Q Okay. And I understand -- well, I -- I'm not</p> <p>16 under oath. I think I understand the --</p> <p>17 MR. RILEY: You wouldn't lie, though.</p> <p>18 Q (BY MR. WALKER) -- reasons for your casting</p> <p>19 out the fifth sample. You believe it not to be valid</p> <p>20 because of its difference from the other four. Is that</p> <p>21 correct?</p> <p>22 A That's correct.</p> <p>23 Q All right. Aside from that professional</p> <p>24 opinion on your part, would you agree with me that</p> <p>25 casting out and not using that fifth sample is somewhat</p>	444	<p>1 MR. RILEY: Or we can break for lunch,</p> <p>2 whatever the group would prefer.</p> <p>3 JUDGE WALSTON: We'll go ahead and break</p> <p>4 for lunch.</p> <p>5 MR. RILEY: All right.</p> <p>6 JUDGE WALSTON: All right. And we'll go</p> <p>7 off the record, and we'll resume at 1:15.</p> <p>8 (Recess: 12:08 p.m. to 1:23 p.m.)</p> <p>9</p> <p>10</p> <p>11</p> <p>12</p> <p>13</p> <p>14</p> <p>15</p> <p>16</p> <p>17</p> <p>18</p> <p>19</p> <p>20</p> <p>21</p> <p>22</p> <p>23</p> <p>24</p> <p>25</p>
443	<p>1 arbitrary based on your assessment because it did not</p> <p>2 fit with the other four?</p> <p>3 A It's not arbitrary. It doesn't fit the model</p> <p>4 of the five. It's not -- I mean, it's significantly</p> <p>5 different with this permeability which indicates it's a</p> <p>6 low permeability portion of the sand and not indicative</p> <p>7 of the area that would be injected into.</p> <p>8 Q But it was taken from the area. Right?</p> <p>9 A It was taken from the same injection interval,</p> <p>10 yes.</p> <p>11 Q Okay.</p> <p>12 MR. WALKER: That's all I have, Your</p> <p>13 Honor.</p> <p>14 JUDGE WALSTON: Okay. Public interest</p> <p>15 counsel?</p> <p>16 MR. McWHERTER: I have no questions at</p> <p>17 this time.</p> <p>18 JUDGE WALSTON: Executive Director?</p> <p>19 MS. GOSS: Mr. Casey, we have no questions</p> <p>20 for you today. Thank you.</p> <p>21 JUDGE WALSTON: Any further?</p> <p>22 MR. RILEY: A few questions on redirect,</p> <p>23 which I could probably cover in -- by 12:30 or so, if we</p> <p>24 want to finish with this witness.</p> <p>25 JUDGE WALSTON: All right.</p>	445	<p>1 AFTERNOON SESSION</p> <p>2 THURSDAY, JUNE 17, 2010</p> <p>3 (1:23 p.m.)</p> <p>4 JUDGE EGAN: This is 582-07-2673, and</p> <p>5 582-07-2674.</p> <p>6 And I believe, Mr. Walker has a</p> <p>7 preliminary matter or a housekeeping matter that he</p> <p>8 needs to take care of.</p> <p>9 MR. WALKER: Yes, Your Honor, we received</p> <p>10 a message from one of our witnesses, Dr. Paul Pearce,</p> <p>11 that he will not be available next Monday and Tuesday.</p> <p>12 It seems appropriate to me to ask him to be here</p> <p>13 tomorrow, perhaps right after lunch.</p> <p>14 And whether he gets on the stand then, or</p> <p>15 at some point tomorrow afternoon, I would ask indulgence</p> <p>16 of the two honorable judges to allow us to let him</p> <p>17 testify sometime tomorrow.</p> <p>18 JUDGE EGAN: I believe if -- Mr. Forsberg,</p> <p>19 do you have witnesses you need to call early?</p> <p>20 MR. FORSBERG: Yes, I did have two</p> <p>21 witnesses I needed to call tomorrow as well; although,</p> <p>22 upon the length of their prefiled testimony and the</p> <p>23 limited issues, I don't suspect they will take all day,</p> <p>24 but I could be wrong.</p> <p>25 MR. RILEY: I don't think they will take</p>

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446	<p>1 all day.</p> <p>2 JUDGE EGAN: Do you have any problems with</p> <p>3 either request?</p> <p>4 MR. RILEY: No.</p> <p>5 JUDGE EGAN: If you-all can get together</p> <p>6 and figure out who is going to be here first thing in</p> <p>7 the morning, we'll go ahead and -- Mr. Hill, since we</p> <p>8 may be to your case, do you have any problems with them</p> <p>9 going out of order?</p> <p>10 MR. HILL: No, none at all.</p> <p>11 MR. RILEY: The only qualifier is that we</p> <p>12 have been cooperating and circulating messages so we get</p> <p>13 as much notice as possible as to what the order of</p> <p>14 witnesses will be.</p> <p>15 MR. FORSBERG: Absolutely.</p> <p>16 JUDGE EGAN: Y'all are fine with that.</p> <p>17 Right?</p> <p>18 MR. FORSBERG: Yes, absolutely.</p> <p>19 JUDGE EGAN: Mr. Casey, you are still</p> <p>20 under oath.</p> <p>21 Mr. Riley, are you ready with your</p> <p>22 re-redirect?</p> <p>23 MR. RILEY: Yes.</p> <p>24 JUDGE EGAN: You may proceed, Mr. Riley.</p> <p>25 THE REPORTER: Judge, I am having a</p>	448	<p>1 upwards along the casing itself.</p> <p>2 Q So earlier when you were discussing this topic</p> <p>3 with Ms. Mendoza the casing is actually tested as part</p> <p>4 of mechanical testing. Is that right?</p> <p>5 A Yes, it is.</p> <p>6 Q You mentioned annual testing. Could you</p> <p>7 explain -- why did you choose the phrase or use the word</p> <p>8 "annual testing"?</p> <p>9 A As part of the Class I program, we are required</p> <p>10 to test each well annually for mechanical integrity,</p> <p>11 including annular pressure test, radioactive tracer</p> <p>12 survey, and also a bottom hole pressure survey.</p> <p>13 Q Is there also a falloff test required under the</p> <p>14 TCEQ rules or in the proposed permit annually?</p> <p>15 A Yes. The bottom hole pressure survey is</p> <p>16 basically required to do an analysis of a bottom hole --</p> <p>17 I forget the exact words they use they use -- but</p> <p>18 basically do a bottom hole pressure falloff test to</p> <p>19 determine and analyze for permeability each year.</p> <p>20 Q It's possible -- a reasonable belief that it</p> <p>21 will happen, that other experts in this case will talk</p> <p>22 about the permeability being a static value.</p> <p>23 In other words, that one should find the</p> <p>24 permeability of rock to be the same no matter when it's</p> <p>25 tested. Just accept that as a premise, if you would.</p>
447	<p>1 computer problem. May I fix it real quick?</p> <p>2 (Discussion off the record)</p> <p>3 PRESENTATION ON BEHALF OF</p> <p>4 TEXCOM GULF DISPOSAL, LLC (CONTINUED)</p> <p>5 FURTHER REDIRECT EXAMINATION</p> <p>6 BY MR. RILEY:</p> <p>7 Q Good afternoon, Mr. Casey.</p> <p>8 A Good afternoon.</p> <p>9 Q Mr. Casey, I have a relatively small number of</p> <p>10 questions for you, but it will jump around a bit. Let's</p> <p>11 first talk about mechanical testing of the existing well</p> <p>12 at the TexCom site, WDW410, also referred to as 315, or</p> <p>13 WDW315, because of its prior permit.</p> <p>14 A Yes, sir.</p> <p>15 Q In September of 2009, was the mechanical</p> <p>16 testing of the well limited to the annular space?</p> <p>17 A No, sir.</p> <p>18 Q Could you explain the entirety of the</p> <p>19 mechanical testing of WDW410?</p> <p>20 A As part of the annual testing, we had to</p> <p>21 conduct the radioactive tracer survey of the well, which</p> <p>22 basically tests the integrity of the casing below the</p> <p>23 injection packer to ensure that all the waste fluid</p> <p>24 is -- or the injection fluid is traveling down the well</p> <p>25 and out into the perforations and not traveling back</p>	449	<p>1 Is that okay?</p> <p>2 A Sure.</p> <p>3 Q Why would, then, an annual test evaluating</p> <p>4 permeability be necessary?</p> <p>5 A Well, the state requires it to analyze whether</p> <p>6 the process of injection is affecting the permeability</p> <p>7 of the reservoir, that the permeability is not changing</p> <p>8 over time.</p> <p>9 Q So is it fair to say, then, over the 30-year</p> <p>10 period -- let me explain why I use 30 years. I am using</p> <p>11 30 years because it is my understanding that the</p> <p>12 modeling that is done in these cases contemplates</p> <p>13 maximum rate of injection, maximum volume 24 hours a</p> <p>14 day, seven days a week for 30 years.</p> <p>15 Is that your understanding?</p> <p>16 A That's correct.</p> <p>17 Q And is it correct, then, if annual tests are</p> <p>18 required, there would be 30 tests over that 30 year</p> <p>19 period?</p> <p>20 A That's correct.</p> <p>21 Q And in those 30 tests, permeability of the</p> <p>22 injection interval would be evaluated. Is that also</p> <p>23 true?</p> <p>24 A That is correct.</p> <p>25 Q If permeability declines, let's say in TCEQ's</p>

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<p>1 view, what is your understanding of what consequences</p> <p>2 there might be to a test done, say, in year 15</p> <p>3 indicating that the permeability of the injection</p> <p>4 interval has declined?</p> <p>5 A They might require you to do an additional</p> <p>6 analysis and conduct some sort of workover type</p> <p>7 operation to try to increase the permeability, if it's</p> <p>8 causing a problem. They could require you to remodel.</p> <p>9 It's strictly up to the TCEQ at that point.</p> <p>10 Q So TCEQ has a concern about the changes in</p> <p>11 permeability over this 30-year period. They have</p> <p>12 options -- regulatory options for addressing those</p> <p>13 changes. Is that true?</p> <p>14 A Yes, they do.</p> <p>15 Q The core samples that we have been discussing,</p> <p>16 and there was questions, I believe, by Mr. Walker</p> <p>17 about -- there was others, too, so I don't want to blame</p> <p>18 him. But we talked about dropping out some of the data</p> <p>19 or you would exclude some of the data from the OMNI</p> <p>20 report. Is that the right --</p> <p>21 A Yeah. That's -- there is one -- of the five</p> <p>22 samples used for the air permeability chart, we dropped</p> <p>23 one sample from the analysis.</p> <p>24 Q When you say "we dropped" is that, in the</p> <p>25 course of this discussion, you have evaluated the OMNI</p>	<p>1 you, Page 11.</p> <p>2 JUDGE EGAN: I'm sorry. What was it</p> <p>3 again?</p> <p>4 MR. RILEY: TexCom Exhibit 84, Page 11.</p> <p>5 A Okay.</p> <p>6 Q (BY MR. RILEY) About the middle of the page, I</p> <p>7 think it gives the -- this is your prefiled testimony,</p> <p>8 but I think it might refresh your recollection as to the</p> <p>9 extent of the lower Cockfield member in the area of</p> <p>10 WDW410.</p> <p>11 A Yes. Starting at Line 7 at the number 2. It</p> <p>12 says, Lower Cockfield number is 6045 to 6390 feet.</p> <p>13 Q Just looking at that, it looks like about 345</p> <p>14 feet?</p> <p>15 A That's correct.</p> <p>16 Q When you evaluated or modeled, what dimension</p> <p>17 did you give for the injection interval?</p> <p>18 A We just used the perforated interval, which is</p> <p>19 145 feet.</p> <p>20 Q To the casual observer, it looks like there is</p> <p>21 about 200 feet of rock in that interval that was not</p> <p>22 evaluated. Is that correct? It was not used as part of</p> <p>23 the injection interval?</p> <p>24 A That's right. As part of the modeling, the</p> <p>25 TCEQ has always used the perforation height or amount of</p>
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<p>1 report in light of Ms. Mendoza's questions and other</p> <p>2 parties' questions and my questions, and it is your</p> <p>3 opinion that that value is an outlier?</p> <p>4 A Yes, sir. That's correct.</p> <p>5 Q To be clear, though, as it pertains to the</p> <p>6 first falloff test, meaning the falloff test done by</p> <p>7 Crossroads or on behalf of Crossroads, were the</p> <p>8 perforations in the well, do they correspond or relate</p> <p>9 to the depths of the core samples that were tested in</p> <p>10 the lab?</p> <p>11 A No, sir. The area of the well permitted by</p> <p>12 Crossroads was below where the core was taken.</p> <p>13 Q This whole vertical/horizontal thing has gotten</p> <p>14 me in a spin. Could we go over once more why -- let's</p> <p>15 talk about it this way.</p> <p>16 What is the -- I'll call it the height.</p> <p>17 What is the extent of the lower Cockfield? How many</p> <p>18 feet is the lower Cockfield in the area of this well?</p> <p>19 A Off the top of my head, I'm really not sure.</p> <p>20 The top of our zone is at 6045.</p> <p>21 Q We'll take a minute, and we'll try to find a</p> <p>22 reference.</p> <p>23 MR. RILEY: Give us just a second.</p> <p>24 Q (BY MR. RILEY) If you look at TexCom</p> <p>25 Exhibit 84, which hopefully is somewhere in front of</p>	<p>1 perforations as the modeling interval, discounting any</p> <p>2 additional zone that may take the waste once it leaves</p> <p>3 the wellbore.</p> <p>4 Over time it is going to travel within</p> <p>5 that confined portion of the reservoir in the lower</p> <p>6 Cockfield. It will fill up the entire lower Cockfield</p> <p>7 over time, but from a modeling standpoint, we limit it</p> <p>8 to just the 145 feet.</p> <p>9 Q Would you say that's another measure of</p> <p>10 conservative evaluation in this case?</p> <p>11 A Yes, it is.</p> <p>12 Q The 145 feet, though, when we were -- you were</p> <p>13 asked a number of questions earlier about transmissivity</p> <p>14 across the fault and the difference between horizontal</p> <p>15 and vertical. Do you recall those questions?</p> <p>16 A Yes, sir.</p> <p>17 Q Let's go over that one more time.</p> <p>18 Tell us the difference between horizontal</p> <p>19 transmissivity and vertical transmissivity in the</p> <p>20 context of our discussion.</p> <p>21 A Are we discussing at the fault?</p> <p>22 Q No, sir. In general, let's talk about the</p> <p>23 lower Cockfield.</p> <p>24 A Horizontal transmissivity or permeability is</p> <p>25 typically, on an average, 10 times higher than vertical</p>

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<p style="text-align: right;">454</p> <p>1 permeability would be. It's much easier for the fluids 2 to flow horizontally through the sands than to travel 3 vertically within the sand members -- sand shale 4 members.</p> <p>5 Q Do you think that general statement or general 6 principle underlies some of the TCEQ's position of why 7 one would model only the perforation interval?</p> <p>8 A I could suppose that. I don't know what drives 9 their decision-making on what they require in modeling.</p> <p>10 Q In any event, it would be consistent with what 11 you have just told us about the general principle of 12 horizontal transmissivity and vertical transmissivity in 13 rock stratum, that it would be conservative, or it 14 corresponds with the notion of vertical transmissivity 15 as 10 times less.</p> <p>16 Would you agree with that?</p> <p>17 A Yes.</p> <p>18 MS. MENDOZA: Objection, form. 19 MR. FORSBERG: Objection, form. 20 JUDGE EGAN: The witness has already 21 answered, but do you want to rephrase your question? 22 MR. RILEY: Sure.</p> <p>23 Q (BY MR. RILEY) Do you see any relationship, 24 Mr. Casey, between what you have told us about the 25 general principle of vertical transmissivity being 10</p>	<p style="text-align: right;">456</p> <p>1 Q Now, let's go to the fault. And by "the 2 fault," I am referring to the 4400-foot fault that we 3 have been discussing collectively over the last couple 4 of days in various ways.</p> <p>5 I believe Ms. Mendoza referred you to the 6 window and had you imagine that that was the fault, and 7 then asked you if the fault could be vertically 8 transmissive.</p> <p>9 A Yes, sir, that was the question she asked.</p> <p>10 Q Do you have an opinion as to whether -- in the 11 context of this case with the lower Cockfield being the 12 subject -- do you have an opinion whether the fault 13 would be vertically transmissive?</p> <p>14 A It is my opinion that the vertical 15 transmissivity would be very low, if at all, mainly due 16 to the sand shale nature of the formation. It's not -- 17 unlike if you are in a hard rock environment, like, out 18 in the East Coast area where rock is very hard and you 19 have -- when you break the rock, you actually have a 20 void space created.</p> <p>21 These types of faults in this shaley sand 22 is a displacement, but it tends to be -- your grains are 23 still touching one another. You are not separated by 24 any sort of distance along the fault. So you have sand 25 and shale still intermixed along the fault plane.</p>
<p style="text-align: right;">455</p> <p>1 times less than horizontal transmissivity, and the 2 TCEQ's position upon how one would model an injection 3 interval?</p> <p>4 A Yes.</p> <p>5 MR. RILEY: If we have done nothing else 6 today, we have learned. . . 7 (laughter)</p> <p>8 Q (BY MR. RILEY) What relationship would you 9 think there might be, Mr. Casey?</p> <p>10 A Well, I think the TCEQ, in all the work they 11 did to develop the regulations and their policies, see 12 that the horizontal permeability or transmissivity is a 13 driving force in how a pressure buildup is taking place, 14 so they are limiting you to your injection interval 15 because it may or may not travel above or below that 16 depth.</p> <p>17 With vertical permeability being 18 significantly less than horizontal, they can't say -- 19 even though you got -- let's say you had 300 feet of 20 sandstone, but you have 50 feet of perforations, you 21 can't tell them that it is going to leave that 50 feet 22 and go into the 300.</p> <p>23 So they limit you to whatever your 24 perforated interval height is, that's what they want you 25 to model.</p>	<p style="text-align: right;">457</p> <p>1 Q And thank you, Mr. Casey, I appreciate your 2 testimony.</p> <p>3 MR. RILEY: I am through with the witness. 4 JUDGE EGAN: Any recross from Lone Star? 5 MR. HILL: No questions. I pass the 6 witness. 7 JUDGE EGAN: Any further questions from 8 Denbury?</p> <p>9 FURTHER RECROSS-EXAMINATION</p> <p>10 BY MS. MENDOZA:</p> <p>11 Q Mr. Casey, on the subject of horizontal and 12 vertical transmissivity, in your first testimony in this 13 case you submitted a model that showed your pressures 14 being transmitted into the middle Cockfield. Correct? 15 Across the 4400 fault. Correct?</p> <p>16 A Yes.</p> <p>17 Q And so in your model, when you were over on the 18 north side of the 4400 fault, you used an effective 19 height of 145 feet for your model. Is that correct?</p> <p>20 A Honestly, I'm not sure exactly what the height 21 was on the other side of the fault. I don't remember 22 exactly how the model was created across the fault 23 plane.</p> <p>24 Q So you used a -- you used, though, whatever the 25 equivalent of your perms were. Correct? Over in there,</p>

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<p style="text-align: right;">458</p> <p>1 isn't that just how you testified the TCEQ tells you to 2 model?</p> <p>3 A That's how they tell us to model, but I am not 4 sure with the -- the way the fault juxtaposed -- what 5 the height was on the other side of the fault.</p> <p>6 MR. RILEY: I think it might help, 7 hopefully -- well, the question was originally on the 8 north side, meaning on the side of the TexCom well. I 9 think the answer -- the witness is answering about the 10 other side of the fault.</p> <p>11 Q (BY MS. MENDOZA) I'm sorry. I was asking from 12 the TexCom well to the fault, on the north of the fault, 13 you used a formation height in your model of 145 feet. 14 Is that correct?</p> <p>15 A Yes, ma'am.</p> <p>16 Q But I am going to ask the next question, which 17 is on the south side of the fault, did you use a net 18 layer thickness of 401 feet?</p> <p>19 A I am not sure. What I answered, I'm not sure 20 what we used on the other side of the fault.</p> <p>21 Q You used a greater thickness on the other side 22 of the fault. You remember that. Correct?</p> <p>23 A I'll be honest with you. I haven't looked at 24 that model in a number of years, so I'm not sure what 25 the height was on the other side of the fault.</p>	<p style="text-align: right;">460</p> <p>1 Q So I am clear, you modeled -- 145 feet comes up 2 to the fault, you have a fault and it was transmissive 3 in your first model. And then on the other side of the 4 fault, you used 401 feet. Correct?</p> <p>5 A In this model, yes.</p> <p>6 Q And for the fluids and the pressure to spread 7 out across 401 feet, you assumed vertical permeability. 8 Correct?</p> <p>9 A That would be the indication, yes.</p> <p>10 Q In fact, at the fault you assumed infinite 11 vertical permeability in this model. Correct?</p> <p>12 A We chose -- basically, we treat it as a 13 infinite acting reservoir because of the extremely high 14 permeability on the other side of the fault in the 15 middle Cockfield. It goes from -- the middle Cockfield 16 has a higher permeability than the lower.</p> <p>17 So with the higher permeability, we 18 treated it with -- basically to treat it like an 19 infinite acting reservoir because it had a huge change 20 in permeability across.</p> <p>21 Q I think that -- I want to make sure when I hear 22 you say "infinite acting reservoir," I think that you 23 are talking about the boundary conditions.</p> <p>24 Are you talking about the boundary 25 conditions?</p>
<p style="text-align: right;">459</p> <p>1 Q Do you by any chance have a volume there in 2 front of you that has TexCom Exhibit 6, Page -- you 3 probably don't have -- do you have TexCom Exhibit 6, 4 Page 124 in front of you?</p> <p>5 If not, I will find my copy. I don't know 6 if that will reach to Page 124 or not.</p> <p>7 A Page 124?</p> <p>8 Q 124, yes.</p> <p>9 JUDGE EGAN: Give us just a second. 10 Mr. Casey, have you gotten there?</p> <p>11 WITNESS CASEY: Yes, ma'am, sure have.</p> <p>12 Q (BY MS. MENDOZA) Does this refresh your 13 recollection at all about the net layer thickness that 14 you used on the south side of the fault in the model 15 that you offered with the application in your first 16 testimony?</p> <p>17 A It looks like, according to the table, that in 18 the middle Cockfield on the other side of the fault the 19 net layer thickness used was 401 feet.</p> <p>20 Q Do you need to check all the amendments to that 21 application to make sure that that's the same number all 22 the way through, or do you believe that's the same 23 number all the way through all the amendments?</p> <p>24 A I don't remember ever changing that number. I 25 think it's correct.</p>	<p style="text-align: right;">461</p> <p>1 A Well, it's similar. The boundary conditions 2 for the fault are -- it's a closed boundary fault. 3 Excuse me. It's a closed boundary model -- not fault -- 4 closed boundary fault. Sorry.</p> <p>5 Q Correct.</p> <p>6 A So when we modeled it crossing the fault at the 7 distance away from the injection well, since it goes 8 from the lower permeability, lower Cockfield into the 9 high permeability middle Cockfield, we gave it a lot 10 larger size because the permeability difference would 11 allow it to dissipate pressure significantly faster 12 because of the high permeability.</p> <p>13 So the way in which it was modeled, it was 14 modeled as a, quote, infinite acting portion of the 15 reservoir because of the higher permeability.</p> <p>16 Q So you used different permeabilities in your 17 model for the lower Cockfield on the north side of the 18 fault and the middle Cockfield on the upper side of the 19 fault?</p> <p>20 A Yes, because there is different permeabilities 21 in the two formations.</p> <p>22 Q Thank you.</p> <p>23 MS. MENDOZA: No further questions.</p> <p>24 JUDGE EGAN: Mr. Forsberg?</p> <p>25 MR. FORSBERG: Nothing further.</p>

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462	<p>1 JUDGE EGAN: Ms. Goss?</p> <p>2 MS. GOSS: Nothing.</p> <p>3 JUDGE EGAN: Then, Mr. Casey, you may</p> <p>4 finally be excused.</p> <p>5 WITNESS CASEY: Thank you.</p> <p>6 JUDGE EGAN: Mr. Riley, does that</p> <p>7 conclude?</p> <p>8 MR. RILEY: Yes, ma'am. That is the</p> <p>9 Applicant's direct case.</p> <p>10 JUDGE EGAN: Is Lone Star ready to</p> <p>11 proceed?</p> <p>12 MR. HILL: We are, Your Honor. The</p> <p>13 District calls Phil Grant.</p> <p>14 JUDGE EGAN: You may proceed.</p> <p>15 MR. HILL: Thank you, Your Honors.</p> <p>16 PRESENTATION ON BEHALF OF LONE STAR</p> <p>17 BROWNWATER CONSERVATION DISTRICT</p> <p>18 PHILIP GRANT,</p> <p>19 having been first duly sworn, testified as follows:</p> <p>20 DIRECT EXAMINATION</p> <p>21 BY MR. HILL:</p> <p>22 Q Good afternoon, Mr. Grant.</p> <p>23 A Good afternoon.</p> <p>24 Q Would you mind, go ahead for the purposes of</p> <p>25 the record in stating your name.</p>	464	<p>1 Q Do you have any errors or corrections that you</p> <p>2 wish to make into the record at this time?</p> <p>3 A No, I do not.</p> <p>4 Q Is District Exhibit 22 your testimony, or</p> <p>5 rather, do you adopt District Exhibit 22 as your</p> <p>6 testimony as though you were giving it here live under</p> <p>7 oath today?</p> <p>8 A I do.</p> <p>9 MR. HILL: With that, Your Honor, the</p> <p>10 District offers Exhibits 22, 23, 24, 25, 26 into the</p> <p>11 record.</p> <p>12 JUDGE EGAN: District 22, 23, 24, 25, 26</p> <p>13 are admitted.</p> <p>14 (Exhibit District Nos. 22-26 marked and</p> <p>15 admitted)</p> <p>16 MR. HILL: I pass the witness.</p> <p>17 JUDGE EGAN: We'll do TexCom, and then</p> <p>18 proceed with the rest of Denbury, Individual</p> <p>19 Protestants, Aligned Protestants, OPIC and the ED.</p> <p>20 MR. RILEY: This is one of those common</p> <p>21 problems that we always solve the same way, and then we</p> <p>22 adjust as time goes on.</p> <p>23 As the Applicant, obviously, it's possible</p> <p>24 there will be some friendly cross-examination along the</p> <p>25 way, so one possibility, and I know the Executive</p>
463	<p>1 A Philip Robert Grant.</p> <p>2 Q Mr. Grant, you have in front of you the</p> <p>3 document marked -- actually, a series of documents</p> <p>4 marked District Exhibit 22, District Exhibit 23,</p> <p>5 District Exhibit 24, District Exhibit 25, District</p> <p>6 Exhibit 26.</p> <p>7 Will you be able to find those exhibits in</p> <p>8 front of you?</p> <p>9 A Yes, sir.</p> <p>10 Q Would you mind identifying what that series of</p> <p>11 exhibits constitutes?</p> <p>12 A It's my prefiled direct testimony, and it also</p> <p>13 includes this Exhibit 27.</p> <p>14 MR. HILL: For the record, District 27 is</p> <p>15 the prefiled testimony of Richard Tramm, so we'll offer</p> <p>16 that at the appropriate time after you have Mr. Tramm on</p> <p>17 the stand.</p> <p>18 Q (BY MR. HILL) Is the testimony contained in</p> <p>19 District Exhibit 22 your testimony, Mr. Grant?</p> <p>20 A Yes, sir.</p> <p>21 Q Have you had the opportunity since you have</p> <p>22 finalized developing this prefiled testimony to review</p> <p>23 it again for any errors or corrections you may need to</p> <p>24 make?</p> <p>25 A Yes, I have.</p>	465	<p>1 Director has the -- by rule goes last. My suggestion</p> <p>2 would be to reorder cross-examination so the Applicant</p> <p>3 goes before the Executive Director.</p> <p>4 If that's not appropriate, then we can</p> <p>5 talk about at an appropriate time. If there has been</p> <p>6 some bolstering cross-examination, whether we would be</p> <p>7 allowed some latitude for additional cross-examination.</p> <p>8 I have seen it handled either way.</p> <p>9 JUDGE EGAN: Anybody else want to make any</p> <p>10 comments? Then we are fine with making that change.</p> <p>11 You can go last.</p> <p>12 In that case, it would be Denbury's turn.</p> <p>13 MS. MENDOZA: Thank you.</p> <p>14 CROSS-EXAMINATION</p> <p>15 BY MS. MENDOZA:</p> <p>16 Q Mr. Grant, my name is Mary Mendoza. I</p> <p>17 represent Denbury. Good afternoon.</p> <p>18 A Good afternoon.</p> <p>19 Q I just have a few things that I wanted to talk</p> <p>20 about.</p> <p>21 Do you have an understanding of what the</p> <p>22 difference is between an injection zone and an injection</p> <p>23 interval?</p> <p>24 A Yes, ma'am.</p> <p>25 Q Can you tell me, what is the difference between</p>

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466	<p>1 an injection zone and an injection interval?</p> <p>2 A An injection zone, as defined by the TCEQ, is</p> <p>3 the entire vertical extent of strata that a Class I</p> <p>4 injection well is permitted for and defined -- the</p> <p>5 thickness defined as an injection zone.</p> <p>6 A subgrouping of that is the injection</p> <p>7 interval, which is the strata within the injection zone</p> <p>8 in which direct emplacement of injectate is permitted.</p> <p>9 Q I have looked at some of the modeling that you</p> <p>10 have done in your testimony, and I believe you used a</p> <p>11 model that was called PRESS2. Is that correct?</p> <p>12 A Yes, ma'am.</p> <p>13 Q Does PRESS2 include a skin factor in it?</p> <p>14 A No, ma'am.</p> <p>15 Q Does the skin factor affect the permeability</p> <p>16 that you -- that is in the formation?</p> <p>17 A Not out past the wellbore. Out in a portion of</p> <p>18 the formation away from the wellbore, no, the skin is</p> <p>19 not affected.</p> <p>20 Q So skin affects permeability near wellbore</p> <p>21 conditions -- or near the wellbore?</p> <p>22 A The actual definition of skin is at the rock</p> <p>23 face between the bore hole and the formation the rock</p> <p>24 faces where the skin is defined.</p> <p>25 Q Have you seen wells before with zero skin?</p>	468
467	<p>1 Q Why do you typically set the packer in a well</p> <p>2 immediately above the injection interval?</p> <p>3 A To be able to continuously monitor as much of</p> <p>4 the casing through monitoring of the annular space</p> <p>5 during the operation of the well.</p> <p>6 Q To the extent that there is casing below the</p> <p>7 packer, is that casing continuously monitored during the</p> <p>8 operation of an injection well?</p> <p>9 A No, ma'am.</p> <p>10 Q Is it monitored during the annual test only?</p> <p>11 A Yes, it is. The casing is evaluated during the</p> <p>12 radioactive tracer survey -- the portion of the casing</p> <p>13 below the packer.</p> <p>14 Q Mr. Grant, have you performed or supervised</p> <p>15 falloff tests before?</p> <p>16 A Yes, ma'am.</p> <p>17 Q When you perform or supervise a falloff test,</p> <p>18 how do you make sure that the fluid that you are</p> <p>19 injecting is at the correct specific gravity so that you</p> <p>20 are able to comply with the permit that you have?</p> <p>21 A Typically on a well that is in service,</p> <p>22 specific gravity is, if not continuously monitored,</p> <p>23 monitored at least once every 12 or 24 hours, depending</p> <p>24 upon the permit conditions of that well.</p> <p>25 For a brand new well, if we have to bring</p>	469
467	<p>1 A Not exactly zero. They are either negative or</p> <p>2 positive. I have never seen one exactly with a zero</p> <p>3 skin, based on a falloff test, which is the only</p> <p>4 methodology I have to determine the skin.</p> <p>5 Q Did you look at the falloff tests that were</p> <p>6 done on WDW410?</p> <p>7 A In 2009?</p> <p>8 Q Either in 2009 or in 1999?</p> <p>9 A Yes, ma'am.</p> <p>10 Q And did you look at both of those tests?</p> <p>11 A Yes, ma'am.</p> <p>12 Q Did either one of those find a negative skin?</p> <p>13 A Not that I can recall.</p> <p>14 Q Do you believe it to be reasonable to assume</p> <p>15 zero skin?</p> <p>16 A From the falloff test, it's very unlikely.</p> <p>17 Q Do you have an opinion about where the packer</p> <p>18 needs to be set in WDW410?</p> <p>19 A Typically, when we would oversee the drilling</p> <p>20 in the completion of a Class I injection well, our</p> <p>21 company would set the packer immediately above or into</p> <p>22 the top of the injection interval.</p> <p>23 Q Do you believe that the packer and WDW410 is</p> <p>24 set right immediately above the injection interval?</p> <p>25 A No, it is not.</p>	469
469	<p>1 out brine and/or fluid to run the falloff test, we would</p> <p>2 typically take -- make an analysis or have the supply</p> <p>3 company make an analysis of that brine and give us the</p> <p>4 specific gravity value, and we would make sure it fits</p> <p>5 within our permit limitations.</p> <p>6 Q Do you believe it is acceptable to exceed the</p> <p>7 specific gravity limitations in a UIC permit issued by</p> <p>8 the TCEQ?</p> <p>9 A No, ma'am.</p> <p>10 Q Do you believe it is standard industry practice</p> <p>11 to exceed the specific gravity limitations in a UIC</p> <p>12 permit issued by the TCEQ?</p> <p>13 A No, ma'am.</p> <p>14 Q Is it your understanding that for a -- a</p> <p>15 permitted Class I well, such as the one that TexCom is</p> <p>16 applying for, is it acceptable for the injected fluid to</p> <p>17 move throughout the injected zone?</p> <p>18 A Through the injection zone?</p> <p>19 Q Yes.</p> <p>20 A Not through direct emplacement.</p> <p>21 Q But otherwise, if it migrated out of the</p> <p>22 injection interval, through some means, is that -- into</p> <p>23 the injection zone, is that acceptable under a UIC</p> <p>24 permit?</p> <p>25 A Under TCEQ rules, yes, they do allow that.</p>	469

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470	<p>1 Q Mr. Grant, I have seen various things in the</p> <p>2 record talking about the fluvial deltaic nature of the</p> <p>3 lower Cockfield.</p> <p>4 Do you know what I am talking about when I</p> <p>5 talk about "fluvial deltaic"?</p> <p>6 A Yes, ma'am.</p> <p>7 Q Do you agree that the lower Cockfield is of a</p> <p>8 fluvial deltaic nature?</p> <p>9 A Yes. There may be other depositional</p> <p>10 environments, but there are fluvial deltaic environments</p> <p>11 within the lower Cockfield.</p> <p>12 Q Within a fluvial deltaic environment, do you</p> <p>13 agree that there may be preferential pathways for fluids</p> <p>14 to move?</p> <p>15 A Yes, ma'am.</p> <p>16 Q I wanted to ask you: Can you tell me what --</p> <p>17 in layman's terms -- in layman's terms, I understood</p> <p>18 porosity to mean -- essentially, it's a measure of the</p> <p>19 pore space in a given volume of rock expressed as a</p> <p>20 percentage.</p> <p>21 Is that a decent understanding of</p> <p>22 porosity?</p> <p>23 A Yes, that's a reasonable assessment of it.</p> <p>24 Q If I were to ask you, so 24 percent porosity</p> <p>25 would mean in a given volume of rock, I'd essentially</p>	472	<p>1 Q And why is it important to continuously monitor</p> <p>2 the casing below the packer?</p> <p>3 A If you have corrosion of your long string</p> <p>4 casing within the annular space above the packer, if the</p> <p>5 corrosion eventually breaks through to cause leakage of</p> <p>6 fluid out into the formation, it will immediately be</p> <p>7 picked up by a loss in pressure in the annulus.</p> <p>8 Below the packer there is no early warning</p> <p>9 system, you might say, to determine if there has been</p> <p>10 corrosion of that casing. And at that point below the</p> <p>11 packer, the casing is directly exposed to your</p> <p>12 injectate, which is typically more corrosive than the</p> <p>13 fluid you have in your annular space.</p> <p>14 Q So there is a possibility that corrosion could</p> <p>15 occur in the casing below the packer. Is that fair?</p> <p>16 A Yes.</p> <p>17 Q And in the case of WDW410, if there is a breach</p> <p>18 in the casing below the packer, where does the</p> <p>19 injectable material then go?</p> <p>20 A It goes out into the formation.</p> <p>21 Q And specifically what part of the formation</p> <p>22 would it go into?</p> <p>23 A Depending on where the corrosion is. If it is</p> <p>24 below the top of the injection zone, it would go out</p> <p>25 into either the injection zone or the injection</p>
471	<p>1 have 24 percent of that volume would be empty</p> <p>2 space that -- if it were down in the lower Cockfield --</p> <p>3 would be filled with some sort of fluid?</p> <p>4 A Yes, ma'am.</p> <p>5 Q Have you ever seen a rock that has 340 percent</p> <p>6 porosity?</p> <p>7 A No, that's not possible.</p> <p>8 MS. MENDOZA: We have no further</p> <p>9 questions.</p> <p>10 Thank you, Mr. Grant.</p> <p>11 JUDGE EGAN: Mr. Forsberg?</p> <p>12 CROSS-EXAMINATION</p> <p>13 BY MR. FORSBERG:</p> <p>14 Q Good afternoon, Mr. Grant. I just have a</p> <p>15 couple of questions, kind of following up on what you</p> <p>16 were just talking about.</p> <p>17 Just for my understanding, are you saying</p> <p>18 that the packer in WDW410 is too high?</p> <p>19 A It is set slightly above the top of the</p> <p>20 injection zone. I would not set it at that high a</p> <p>21 depth.</p> <p>22 Q Was it my understanding that your testimony is</p> <p>23 that you can't continuously monitor the casing below the</p> <p>24 packer?</p> <p>25 A Correct.</p>	473	<p>1 interval.</p> <p>2 If the corrosion was above the top of the</p> <p>3 injection zone, it would go into the confining zone</p> <p>4 strata.</p> <p>5 Q That's the Jackson shale?</p> <p>6 A Yes, sir.</p> <p>7 Q How long -- well, absent continuously</p> <p>8 monitoring, how long could a breach exist before someone</p> <p>9 realized that that material was escaping from the casing</p> <p>10 below the packer?</p> <p>11 A Assuming a mechanical integrity test was</p> <p>12 performed every 12 months, it could exist from the day</p> <p>13 after the radioactive tracer test from the previous</p> <p>14 mechanical integrity test until the test was next</p> <p>15 performed the following 365 days later, or whatever the</p> <p>16 time frame is.</p> <p>17 Q So in reality, a leak could exist for almost a</p> <p>18 year without anyone knowing?</p> <p>19 A Yes, sir.</p> <p>20 MR. FORSBERG: Thank you. Nothing</p> <p>21 further.</p> <p>22 JUDGE EGAN: Mr. Walker?</p> <p>23 MR. WALKER: Your Honor, I have no</p> <p>24 questions of Mr. Grant.</p> <p>25 MS. GOSS: The ED has no questions for</p>

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<p style="text-align: right;">474</p> <p>1 Mr. Grant.</p> <p>2 JUDGE EGAN: Mr. Riley.</p> <p>3 CROSS-EXAMINATION</p> <p>4 BY MR. RILEY:</p> <p>5 Q Good afternoon, Mr. Grant.</p> <p>6 A Good afternoon, Mr. Riley.</p> <p>7 Q How are you, sir?</p> <p>8 A I'm good. How about yourself?</p> <p>9 Q Doing well.</p> <p>10 MR. RILEY: We have come to be quite</p> <p>11 friendly over the last three meetings, I think.</p> <p>12 Q (BY MR. RILEY) Mr. Grant, four out of five</p> <p>13 geologists agree that the fault -- the 4400-foot fault</p> <p>14 is transmissive.</p> <p>15 Do you still hold the position that the</p> <p>16 4400-foot fault is nontransmissive?</p> <p>17 A Sir, I am not sure what four out of five</p> <p>18 geologists you are speaking of.</p> <p>19 Q Well, I was just trying to be cute.</p> <p>20 Do you remember that old commercial, four</p> <p>21 out of five dentists agree?</p> <p>22 A Vaguely, I do remember that.</p> <p>23 Q Did you ever wonder what the fifth dentist was</p> <p>24 thinking?</p> <p>25 (laughter)</p>	<p style="text-align: right;">476</p> <p>1 A Yes, sir.</p> <p>2 Q And you modeled a permeability of 80.9, and</p> <p>3 modeled the fault as being nontransmissive. Is that</p> <p>4 correct?</p> <p>5 A That is correct.</p> <p>6 Q What was your conclusion in distance as to the</p> <p>7 radius of the cone of influence?</p> <p>8 A May I look at my --</p> <p>9 Q Let me help you a little bit. I think it's on</p> <p>10 Page 4 of your prefiled testimony at the bottom.</p> <p>11 A Directly to the east approximately 3.2 miles</p> <p>12 and to the south along -- southeast along the fault</p> <p>13 approximately 3.4 miles.</p> <p>14 Q So then the maximum distance, in terms of</p> <p>15 radius, is 3.4 miles. Is that true?</p> <p>16 A Under that scenario, yes.</p> <p>17 Q And if my understanding is correct, that's the</p> <p>18 scenario that you modeled following the hearing and the</p> <p>19 TCEQ commissioner's order instructing an analysis using</p> <p>20 the parameter of 80.9 as permeability and treating the</p> <p>21 fault as nontransmissive. Am I right?</p> <p>22 A Yes, sir.</p> <p>23 Q In the first hearing I recall -- and please</p> <p>24 correct me if your recollection is different -- you</p> <p>25 equated the PRESS2 model to the use of a numerical model</p>
<p style="text-align: right;">475</p> <p>1 Q (BY MR. RILEY) Seriously, there are some other</p> <p>2 geologists in this case, including Dr. Langhus, and</p> <p>3 other experts in this field that have opined that the</p> <p>4 4400-foot fault is transmissive in the horizontal</p> <p>5 direction, at least.</p> <p>6 A I understand that.</p> <p>7 Q It is my recollection of your testimony, both</p> <p>8 in this remand hearing and in the original hearing, that</p> <p>9 you have a different opinion?</p> <p>10 A Yes, sir.</p> <p>11 Q What is your opinion again?</p> <p>12 A My opinion is that the 4400-foot south fault is</p> <p>13 laterally sealing.</p> <p>14 JUDGE EGAN: I'm sorry. Could you --</p> <p>15 WITNESS GRANT: The fault is laterally</p> <p>16 sealing.</p> <p>17 Q (BY MR. RILEY) And I remember some</p> <p>18 conversation in the original hearing about layer cakes,</p> <p>19 and frosting, and stuff like that. But the point I'm</p> <p>20 trying to make, is it still your opinion that the fault</p> <p>21 is laterally sealing meaning nontransmissive?</p> <p>22 A Yes, sir.</p> <p>23 Q Now, in your prefiled testimony you did a</p> <p>24 modeling run, or you modeled a scenario. Is that</p> <p>25 correct? Using PRESS2?</p>	<p style="text-align: right;">477</p> <p>1 or a Bost model.</p> <p>2 In other words, you saw those models as</p> <p>3 being equivalent. Is that a fair statement?</p> <p>4 A As far as equivalency, what form of equivalency</p> <p>5 do you mean?</p> <p>6 Q They would both be useful in making the</p> <p>7 evaluation that we're engaged in making as to what the</p> <p>8 cone of influence would be in the context of a UIC</p> <p>9 permit. Is that true?</p> <p>10 A Yes, that they could both be used to determine</p> <p>11 a cone of influence of pressure increase.</p> <p>12 Q And I remember you were very confident that the</p> <p>13 PRESS2 model was the model that the TCEQ instructed</p> <p>14 applicants to use, and you had indeed used in other</p> <p>15 contexts as an applicant's engineer in proposing Class I</p> <p>16 permits to the TCEQ. Is that true?</p> <p>17 A I use it in preparing models for my clients. I</p> <p>18 don't know that the TCEQ staff instructs all applicants</p> <p>19 to use that. I don't believe they do that.</p> <p>20 Q I think they give some flexibility, is my</p> <p>21 recollection of the guidance. But I think PRESS2 is</p> <p>22 specifically mentioned, if I recall correctly, by the</p> <p>23 TCEQ in its guidance as an available model for cone of</p> <p>24 influence calculation. Is that your understanding?</p> <p>25 A That may be the case.</p>

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478	<p>1 Q I am trying to pick -- the variety of topics</p> <p>2 I'm sure we'll spend the afternoon on, I'm trying to</p> <p>3 pick a good one to go next to.</p> <p>4 Let's talk about packer.</p> <p>5 A All right.</p> <p>6 Q And the discussion you had just a few minutes</p> <p>7 ago is that you would have placed the packer closer to</p> <p>8 the top of the injection interval in WDW410.</p> <p>9 Is that true?</p> <p>10 A That is true.</p> <p>11 Q In terms of geologic stratum, where is the</p> <p>12 packer placed in 410? Can I stop saying WDW -- if I say</p> <p>13 410 --</p> <p>14 A I will understand that, yes.</p> <p>15 Q In 410, then, where is the packer placed? At</p> <p>16 what depth and what geologic stratum does that depth</p> <p>17 correspond to?</p> <p>18 A The exact depth, I would have to look at the</p> <p>19 schematic of the well, but I believe it's set at 4108.</p> <p>20 Q Let's have my colleague, Mr. Lee, approach, if</p> <p>21 that's all right. I think it's 5108, but I'm not the</p> <p>22 geologist.</p> <p>23 A I'm not the engineer.</p> <p>24 (laughter)</p> <p>25 A The packer is set at 5108. The length of the</p>	480	<p>1 A Yes, it could.</p> <p>2 Q How would that be done?</p> <p>3 A Through, typically, a workover operation where</p> <p>4 you would bring a workover rig in, and depending upon</p> <p>5 what kind of packer, whether it's retrievable or not,</p> <p>6 you would either unhook it, if it's hooked to the --</p> <p>7 unlatch it, essentially, from the wall of the casing and</p> <p>8 bring it up with your injection tubing string; or</p> <p>9 unlatch the tubing string, go in with the work string,</p> <p>10 and unlatch the packer and bring it to the surface; or</p> <p>11 redress it and reset it; or if it not a retrievable</p> <p>12 packer, you would go in with a mill and drill out the</p> <p>13 packer.</p> <p>14 Q Have you ever been involved in any workover</p> <p>15 operations where that was done or that became necessary?</p> <p>16 A Yes.</p> <p>17 Q Is it common, uncommon, difficult? Do you have</p> <p>18 a sense of complexity of such an operation?</p> <p>19 A It's not a complex operation unless you have a</p> <p>20 permanent packer or a packer that will not unseat, and</p> <p>21 then it becomes a little bit more complex.</p> <p>22 Q Still possible, though?</p> <p>23 A Yes, I believe it's still possible.</p> <p>24 Q Let's talk about skin for a moment.</p> <p>25 Is skin value or the skin factor a</p>
479	<p>1 packer is not known -- is not shown on this diagram, but</p> <p>2 I'm assuming it's probably two feet in length. So from</p> <p>3 probably 5108 to 5110.</p> <p>4 Q I think that's what Mr. Casey said when he was</p> <p>5 asked about -- the same question or something similar</p> <p>6 earlier.</p> <p>7 What is the depth to the top of the upper</p> <p>8 Cockfield in the area -- or in WDW410?</p> <p>9 A I'd have to, again, look at one of the</p> <p>10 stratigraphic columns to tell you for sure on that -- or</p> <p>11 one of the diagrams that you have in the application.</p> <p>12 Q Well, what I can offer you, at least in</p> <p>13 Mr. Casey's testimony, states the upper Cockfield number</p> <p>14 5134 to 5629 feet.</p> <p>15 Does that sound correct to you?</p> <p>16 A The upper Cockfield from 5134 to --</p> <p>17 Q 5629?</p> <p>18 A It doesn't ring a bell, but it's possible.</p> <p>19 Q Without belaboring the point, is the idea that</p> <p>20 the annular space above the packer is something that is</p> <p>21 constantly monitored during well operations?</p> <p>22 Is that what I understood you to say?</p> <p>23 A Yes.</p> <p>24 Q Could the packer be re-placed? In other words,</p> <p>25 could it be placed lower in the well?</p>	481	<p>1 component of a PRESS2 model?</p> <p>2 A No, it is not.</p> <p>3 Q Does the PRESS2 treat skin as zero as far as</p> <p>4 you know?</p> <p>5 A In the instructions for PRESS2, it does note</p> <p>6 that fact.</p> <p>7 Q So that is not an uncommon consideration in</p> <p>8 modeling the type we are discussing that the skin factor</p> <p>9 is treated as zero. Is that right?</p> <p>10 A In modeling pressure increase out away from the</p> <p>11 wellbore as is done in the cone of influence modeling</p> <p>12 with an analytical solution, it is not included -- which</p> <p>13 PRESS2 is an analytical solution.</p> <p>14 Q Do you know the reason, Mr. Grant, that it's</p> <p>15 really not a consideration in the analytical model, and</p> <p>16 PRESS2, for lack of a better term, sets the skin factor</p> <p>17 as zero?</p> <p>18 A The formula to calculate that, whether it's</p> <p>19 referred to as the Mathews & Russell formula, or the</p> <p>20 Theis equation, or whatever variation of that, that it</p> <p>21 goes into the PRESS2 model, does not have an input for</p> <p>22 skin.</p> <p>23 Q Would you agree with me that that's because</p> <p>24 when you are measuring pressure outside the area</p> <p>25 immediately around the wellbore, skin is not a factor?</p>

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482	<p>1 I don't mean to be cute. It's just not something that</p> <p>2 needs to be considered in a measurement outside of the</p> <p>3 immediate area around a wellbore?</p> <p>4 A At the time frame we are talking of 30 years</p> <p>5 into the future out at distance in the formation, no.</p> <p>6 Q I know you have never made a mistake, but is it</p> <p>7 possible that the higher specific gravity than what is</p> <p>8 in the Class 5 permit, that just was an honest mistake</p> <p>9 on Mr. Casey's part?</p> <p>10 A Yes, it's certainly possible.</p> <p>11 Q To the best of your knowledge, do you know if</p> <p>12 TCEQ has taken any enforcement action for that mistake?</p> <p>13 A No, I do not know anything about that.</p> <p>14 Q Granting that it's a mistake, does the specific</p> <p>15 gravity value, now that it's known, does it affect the</p> <p>16 results of the 2009 falloff test?</p> <p>17 A Not in my analysis of the falloff test, no.</p> <p>18 Q So even though it was a mistake Mr. Casey has</p> <p>19 admitted to, and even though it clearly was a higher</p> <p>20 specific gravity, as I recall, than what was provided in</p> <p>21 the Class 5 permit, the falloff test results were not</p> <p>22 affected from that difference.</p> <p>23 Is that a correct statement?</p> <p>24 A Not entirely. Depending upon what equivalent</p> <p>25 viscosity you put in your falloff test analysis, it</p>	484	<p>1 JUDGE EGAN: You may.</p> <p>2 Q (BY MR. RILEY) Mr. Grant, would you approach</p> <p>3 the easel.</p> <p>4 A Is this the same easel as two and a half years</p> <p>5 ago that fell over?</p> <p>6 Q It may be.</p> <p>7 A In that case, I'll get out of the way.</p> <p>8 Q It's not surprising how hard it is to get</p> <p>9 supplies?</p> <p>10 A Is this your easel?</p> <p>11 Q I think it is.</p> <p>12 A Then it's probably booby trapped.</p> <p>13 Q No, no, no.</p> <p>14 (laughter)</p> <p>15 Q Everyone enjoys a little comic relief. Not</p> <p>16 that kind.</p> <p>17 Would you draw, again, in general terms, X</p> <p>18 and Y axis and give us a picture to work with from a</p> <p>19 typical falloff test, what you might see -- in the</p> <p>20 context of our discussion about looking for barriers</p> <p>21 based on a falloff test.</p> <p>22 A A no-fault boundary type barrier?</p> <p>23 Q Yes, sir.</p> <p>24 A Is that what you're talking about?</p> <p>25 Q Let's start with just no barriers -- or the --</p>
483	<p>1 obviously affects your output of your permeability. But</p> <p>2 that's the fashion that it affects it.</p> <p>3 Q So as long as you know what the specific</p> <p>4 gravity was of the injectate, which we do know, because</p> <p>5 we know it was higher than what the value is in the</p> <p>6 permit, one can still use the test to evaluate</p> <p>7 permeability?</p> <p>8 A Yes, sir.</p> <p>9 Q I am told by geologists in this case -- all</p> <p>10 geologists I have met so far -- that there are certain</p> <p>11 things that one can determine from a falloff test, and</p> <p>12 are there -- is there something or a notion or a concept</p> <p>13 called a barrier that is relevant to this discussion?</p> <p>14 A Various reservoir heterogeneities can be</p> <p>15 determined from analysis of the falloff tests assuming</p> <p>16 the radius of investigation goes out to the distance of</p> <p>17 those heterogeneities.</p> <p>18 Q Hold on just a second. I am going to try to</p> <p>19 get a marker and test your math skills.</p> <p>20 A Or my drawing skills?</p> <p>21 Q Yes, sir. Did I say math?</p> <p>22 A Yes.</p> <p>23 Q I'm sorry. I meant art.</p> <p>24 MR. RILEY: Could you give me just a</p> <p>25 second, Judges, I just need to get a marker.</p>	485	<p>1 falloff test would not reveal a barrier, what that would</p> <p>2 look like.</p> <p>3 A Depends on whether we look semi-log plot or the</p> <p>4 log-log plot.</p> <p>5 Q Which one kind of looks like that? What would</p> <p>6 that be?</p> <p>7 A That would be the semi-log plot.</p> <p>8 Q Let's go with that one.</p> <p>9 A This is pressure, this is time, and this</p> <p>10 pressure is on a linear scale, and this time is on a</p> <p>11 logarithmic scale. This would be called a Horner plot</p> <p>12 depending upon whether you use supposition or not.</p> <p>13 Q I'm sorry, Mr. Grant. You are away from your</p> <p>14 mike, so could you keep your voice up a little bit?</p> <p>15 A So early time data is like this, and then it</p> <p>16 flattens out. The data -- this is the plot of the data.</p> <p>17 Q So we're looking -- if I understood you</p> <p>18 correctly, the time is on a log plot. Is that correct?</p> <p>19 A Correct.</p> <p>20 Q And the pressure is on a straight --</p> <p>21 A Linear plot.</p> <p>22 Q Linear plot.</p> <p>23 So the early part of the test is</p> <p>24 represented in your diagram on the right side. Is that</p> <p>25 also correct?</p>

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486	<p>1 A With the software that I use.</p> <p>2 It can actually be reversed. If you use</p> <p>3 different software, you would have a mirror image, but</p> <p>4 the software that I use, the plot is like this.</p> <p>5 Q If I understand you correctly, at least I asked</p> <p>6 you to draw a typical plot that would indicate no</p> <p>7 barriers detected. Is that what you have done?</p> <p>8 A Yes.</p> <p>9 Q Is there anywhere that distance is reflected in</p> <p>10 what you have drawn so far?</p> <p>11 A One can calculate distances, but directly</p> <p>12 reading off of this it is not possible.</p> <p>13 Q So you would look at the time plot, though, if</p> <p>14 you wanted to back calculate, so to speak, distance to a</p> <p>15 barrier, then you could use that using the time plot.</p> <p>16 Am I correct?</p> <p>17 A Yeah, if you saw an anomaly, you could mark it</p> <p>18 and change the scale to a linear or Cartesian plot, and</p> <p>19 then you could -- based upon the Cartesian time using a</p> <p>20 formula, which is similar to radius investigation</p> <p>21 formula, determine at what distance that anomaly</p> <p>22 occurred.</p> <p>23 Q I probably should have done this, but let me</p> <p>24 get you another marker -- a different color -- so that</p> <p>25 we can see what it looks like when you see a barrier or</p>	488	<p>1 or into your zone to keep the pressure at that barrier</p> <p>2 constant, or if it potentially reflects a change in</p> <p>3 thickness going from a stratigraphic change in thickness</p> <p>4 going from 145 feet to 20 feet or 350 feet depending</p> <p>5 upon which way -- depending upon other things you would</p> <p>6 analyze.</p> <p>7 Q Thank you, Mr. Grant.</p> <p>8 Just so it's clear for the record, the</p> <p>9 second marker I have handed and you have described what</p> <p>10 you have done is a red marker. So when we look at the</p> <p>11 record, we will remember what colors meant what in the</p> <p>12 diagram.</p> <p>13 A Just a clarification. I actually turned this</p> <p>14 up. It's probably not turning up on a semi-log. It</p> <p>15 probably just turns a little flatter. It doesn't</p> <p>16 actually turn up.</p> <p>17 Q By "this" you indicated the top red line that</p> <p>18 you drew that turned up a bit, it would more flatten</p> <p>19 out. Is that -- am I understanding correctly?</p> <p>20 A It would do what now?</p> <p>21 Q It would flatten out more than turn up?</p> <p>22 A Correct.</p> <p>23 Q The pressure, the original line you drew in</p> <p>24 black, then, would continue to decline at a gradual</p> <p>25 slope. Is that fair?</p>
487	<p>1 anomaly -- I think is your word.</p> <p>2 Would you draw a -- now draw a plot</p> <p>3 indicating a barrier at some point during the test. I</p> <p>4 keep saying barrier. Let's call it an anomaly. I think</p> <p>5 that was your word.</p> <p>6 A Until you reach the barrier, you would</p> <p>7 potentially see the same curve, and then at some point</p> <p>8 the curve might turn up and potentially turn back</p> <p>9 instead of staying flat.</p> <p>10 Q If it turns up, what might that indicate,</p> <p>11 Mr. Grant?</p> <p>12 A Let me see, on a semi-log, it's probably</p> <p>13 indicating a no-flow barrier; and on a turndown, it's</p> <p>14 potentially indicating a constant recharge type barrier.</p> <p>15 JUDGE WALSTON: A what barrier was the</p> <p>16 last one you said?</p> <p>17 WITNESS GRANT: Constant recharge.</p> <p>18 Q (BY MR. RILEY) You will have to help us a</p> <p>19 little bit with what the term "constant recharge</p> <p>20 barrier" means.</p> <p>21 A Well, you would have -- you could potentially</p> <p>22 have multiple stratigraphic equivalence through a</p> <p>23 constant recharge barrier. You could have a fault or a</p> <p>24 plane, which as you either increase the pressure or</p> <p>25 decrease the pressure, allows pressure bleed off across</p>	489	<p>1 A If it was radial flow with no barriers.</p> <p>2 Q Why don't you just go ahead and finish that</p> <p>3 black line, then, as if there were radial flow with no</p> <p>4 barriers?</p> <p>5 A It depends on how much data you have. This</p> <p>6 goes out, obviously, to the end of your data or your</p> <p>7 reliable data.</p> <p>8 Q Thank you.</p> <p>9 MR. RILEY: At this time -- we can mark it</p> <p>10 at some future time, but I ask that it be marked as</p> <p>11 TexCom Exhibit 96, I believe, and I'd offer it into the</p> <p>12 record as evidence.</p> <p>13 JUDGE EGAN: Any objections to Exhibit 96?</p> <p>14 (no answer)</p> <p>15 JUDGE EGAN: Exhibit 96 is admitted, and</p> <p>16 the court reporter can mark it.</p> <p>17 (Exhibit TexCom No. 96 marked)</p> <p>18 (Exhibit TexCom No. 96 admitted)</p> <p>19 Q (BY MR. RILEY) Thank you, Mr. Grant.</p> <p>20 A Mr. Riley, I just wanted to clarify there is a</p> <p>21 chance that I have reversed these two. One is constant</p> <p>22 recharge, and one is constant recharge, maybe no flow --</p> <p>23 I don't normally look at barriers on this kind of</p> <p>24 presentation. I look at -- to find my slope and</p> <p>25 determine my permeability on the semi-log and use the</p>

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490	<p>1 log-log plot to look at barriers.</p> <p>2 Q Let's get you back to your microphone, and I</p> <p>3 may have a few follow-up questions. But thank you for</p> <p>4 the diagram.</p> <p>5 As part of your preparation in this case,</p> <p>6 did you look at the falloff test report prepared by</p> <p>7 Mr. Casey's firm from --</p> <p>8 A From 2009, yes, sir.</p> <p>9 Q And based on your assessment of the data and</p> <p>10 any review that you did, did you notice or did you</p> <p>11 detect any barriers in the area of investigation of that</p> <p>12 2009 falloff test?</p> <p>13 A There is a change in slope at the very end of</p> <p>14 the data. It is unclear, to me anyway, as to whether</p> <p>15 that is an anomaly or just past the point in the data</p> <p>16 where the data is reliable.</p> <p>17 Q So up to that point is there any indication of</p> <p>18 a barrier up to what you just described?</p> <p>19 A No, sir.</p> <p>20 Q Could you tell me the distance, then -- if I</p> <p>21 recall correctly, the area of investigation was</p> <p>22 2650-some feet. Is that your understanding?</p> <p>23 A Depending upon who did the analysis, it varied.</p> <p>24 But it was from -- as best I can recall, somewhere</p> <p>25 between 2000 to 2500 feet.</p>	492	<p>1 Were you involved in soliciting EPA to perform an</p> <p>2 analysis?</p> <p>3 A No.</p> <p>4 Q So you had no -- you didn't provide any input</p> <p>5 to EPA. Is that a fair assumption?</p> <p>6 A That's correct.</p> <p>7 Q Someone provided you, at some point, with a</p> <p>8 report from EPA?</p> <p>9 A Yes, I believe it was part of TexCom's --</p> <p>10 what's it called -- not -- provision of records, or</p> <p>11 provision of data.</p> <p>12 Q Is it your understanding that TexCom gave you</p> <p>13 this, or gave someone this and came to you?</p> <p>14 A I can't remember. It was provided by the legal</p> <p>15 company there by Jason.</p> <p>16 Q Okay. So let's go back to things that you did</p> <p>17 yourself, as opposed to things that you received and</p> <p>18 have looked at.</p> <p>19 Did you do an evaluation of the falloff</p> <p>20 test and determine an area or radius of investigation?</p> <p>21 A I did an evaluation of the falloff test and</p> <p>22 came up with my own permeability value independent of</p> <p>23 the EPA analysis or the ALL analysis, other than using</p> <p>24 the raw data that was provided by TexCom.</p> <p>25 From my falloff test analysis, I have run</p>
491	<p>1 Q Where did you see an analysis of the area or</p> <p>2 radius of investigation outside of the report prepared</p> <p>3 by Mr. Casey?</p> <p>4 A There is an analysis performed by one of the</p> <p>5 staff members at the U.S. EPA, which I saw it in either</p> <p>6 an email or an attachment copy that was sent to the</p> <p>7 TCEQ.</p> <p>8 Q Is that the exhibit to your prefiled testimony?</p> <p>9 A It is one of the exhibits, yes, sir.</p> <p>10 Q Could you point me to which exhibit it is, sir?</p> <p>11 A I believe it is Exhibit 26 on the page noted as</p> <p>12 summary of EPA analysis. It may be the third or fourth</p> <p>13 page in of Exhibit 26 -- the sixth page, I believe.</p> <p>14 Q Sixth page? I think I am, hopefully, on the</p> <p>15 same page. Is it entitled, "Summary of EPA Analysis,</p> <p>16 TexCom Injection Well WDW410 Falloff Testing,</p> <p>17 February 2, 2010." Is that right?</p> <p>18 A Yes, sir.</p> <p>19 Q And there are a number of different entries</p> <p>20 here. Could you show me where it is that discusses or</p> <p>21 where it is indicated the radius investigation?</p> <p>22 I see where it is -- 2583?</p> <p>23 A That is Greg Casey's analysis, 2583; and EPA's</p> <p>24 analysis is 1425.</p> <p>25 Q Let's talk briefly about the EPA's analysis.</p>	493	<p>1 a PRESS model to determine a radius of investigation.</p> <p>2 Q And I understand that. I guess, did I hear you</p> <p>3 say your radius of investigation based on the PRESS2,</p> <p>4 but I'm looking for radius of investigation that you</p> <p>5 have determined evidenced by the falloff test -- 2009</p> <p>6 falloff test.</p> <p>7 A I'm sorry. Yes, I have determined a radius of</p> <p>8 investigation from that.</p> <p>9 Q Let's get in front of you some notes that I</p> <p>10 believe are yours dated December 23, 2009.</p> <p>11 MR. RILEY: I would like to have this</p> <p>12 document marked TexCom Exhibit 97.</p> <p>13 Q (BY MR. RILEY) Do you have TexCom Exhibit 97</p> <p>14 in front of you, Mr. Grant? It should look very</p> <p>15 familiar. I think it's your handwriting. It's been --</p> <p>16 A This? Has this been labeled as 97?</p> <p>17 Q It will be.</p> <p>18 (Exhibit TexCom No. 97 marked)</p> <p>19 A Yes, I have it.</p> <p>20 Q (BY MR. RILEY) Do you recognize it?</p> <p>21 A Yes, sir.</p> <p>22 Q What do you recognize it to be?</p> <p>23 A I recognize it to be my tabulation of various</p> <p>24 analyses and pressure models as generated up to the date</p> <p>25 of that -- my notes on the top, and my date on the top</p>

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494	<p>1 of the various pressure models and falloff tests</p> <p>2 performed at the TexCom well.</p> <p>3 Q Does this appear to contain all the information</p> <p>4 from your notes, at least on this page, Page 1 of 1,</p> <p>5 does this appear to be complete?</p> <p>6 A It does.</p> <p>7 MR. RILEY: Your Honor, at this time I</p> <p>8 offer into evidence TexCom Exhibit 97.</p> <p>9 JUDGE EGAN: Any objections?</p> <p>10 (no answer)</p> <p>11 JUDGE EGAN: TexCom Exhibit 97 is</p> <p>12 admitted.</p> <p>13 (Exhibit TexCom No. 97 admitted)</p> <p>14 Q (BY MR. RILEY) Now, if I am following along,</p> <p>15 there are several different -- these are just notes you</p> <p>16 took regarding other analyses conducted in this case.</p> <p>17 Correct?</p> <p>18 A Including my analysis?</p> <p>19 Q Yes, sir.</p> <p>20 A Yes.</p> <p>21 Q So we have the notation on 2 at the top that I</p> <p>22 believe refers to pressure falloff test, PFOT. Is that</p> <p>23 correct?</p> <p>24 A Correct.</p> <p>25 Q In the margin, starting with the first one,</p>	496	<p>1 the permit application or calculating a cone of</p> <p>2 influence.</p> <p>3 Q Would you write next to each of those three</p> <p>4 entries, then, the word "model" in the margin.</p> <p>5 A Yes.</p> <p>6 Q Thank you.</p> <p>7 So then if I'm following along, as it</p> <p>8 relates to these notes, the entries that could be</p> <p>9 compared would be the bottom -- the top two and the</p> <p>10 bottom entry, and then the three in the middle. Those</p> <p>11 relate to each other. Is that correct?</p> <p>12 A Yes, they are similar type of analyses.</p> <p>13 Q So let's start at the top with the entry</p> <p>14 labeled 2009 TDI Analysis of September -- 9/09 PFOT.</p> <p>15 Do you see that?</p> <p>16 A Yes.</p> <p>17 Q Who is TDI?</p> <p>18 A Terra Dynamics.</p> <p>19 Q That's you. Right?</p> <p>20 A Yes, sir.</p> <p>21 Q Could you write above the word TDI or above</p> <p>22 letters TDI "Grant," indicating, I believe, that this is</p> <p>23 your analysis. Correct?</p> <p>24 A That is correct.</p> <p>25 Q I think down, the fourth entry, we see TDI</p>
495	<p>1 which I believe is 2009 TDI analysis of 9/09 PFOT.</p> <p>2 Could you write in the margin that this is a falloff</p> <p>3 test. Do you have a pen up there?</p> <p>4 (Witness complies)</p> <p>5 Q (BY MR. RILEY) Have you got that?</p> <p>6 A Yes.</p> <p>7 Q If I am correct, the next entry down also</p> <p>8 relates to analysis of a falloff test. Correct?</p> <p>9 A Correct.</p> <p>10 Q Could you also make the notation alongside the</p> <p>11 second entry.</p> <p>12 A Yes.</p> <p>13 Q Now, is there another pressure or falloff test</p> <p>14 analysis -- I believe it's at the bottom of the page --</p> <p>15 regarding Fairchild's analysis?</p> <p>16 Is that also an analysis of a pressure</p> <p>17 falloff test?</p> <p>18 A Yes, it is.</p> <p>19 Q Next to that entry, which is the bottom entry,</p> <p>20 could you write the words "falloff test."</p> <p>21 A Okay.</p> <p>22 Q So there are three other entries on this page.</p> <p>23 What do these relate to?</p> <p>24 A These relate to the pressure models performed</p> <p>25 by -- at various times by various entities related to</p>	497	<p>1 again. If I am correct, this is also your analysis.</p> <p>2 Could you write the word "Grant" above that.</p> <p>3 A It's not a falloff test analysis. It's a</p> <p>4 pressure model.</p> <p>5 Q Yes, sir.</p> <p>6 A Yes.</p> <p>7 Q All right. So let's -- again, back to the top</p> <p>8 entry, which is an analysis of a pressure falloff test,</p> <p>9 there is an entry just below 2009 of 48.68, and I</p> <p>10 believe the units are millidarcy. Is that correct?</p> <p>11 A That is correct.</p> <p>12 Q So in that analysis you used 48.68</p> <p>13 millidarcies?</p> <p>14 A That's the result of the analysis.</p> <p>15 Q What are the other entries and how do they</p> <p>16 relate to the result of the analysis being 48.68?</p> <p>17 A 145 feet is an input parameter for thickness of</p> <p>18 the interval taking fluid; 0.43 CP means centipoise is a</p> <p>19 reflection of the viscosity of the formation where</p> <p>20 radial flow is occurring, based on the analysis; 15.6</p> <p>21 skin is an output from the analysis indicating what the</p> <p>22 near wellbore or well face skin is; and 16,523</p> <p>23 millidarcy feet for centipoise is more accurately</p> <p>24 defined as transmissibility value.</p> <p>25 Q I'm sorry. I missed what you said about the</p>

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498	<p>1 1.07.</p> <p>2 A I'm sorry. The 1.07 is the equivalent density</p> <p>3 of the formation brine. That is a -- doesn't go into</p> <p>4 the input directly. It is just put in there for</p> <p>5 reference to note where I got the .43 centipoise from.</p> <p>6 Q "SG," does that mean specific gravity?</p> <p>7 A Yes, sir.</p> <p>8 Q So you are taking me where I had hoped to go.</p> <p>9 The specific gravity, 1.07, I understand that relates to</p> <p>10 where you took the value .43 centipoise.</p> <p>11 Could you explain further what fluid, in</p> <p>12 the context of this case, is 1.07 specific gravity?</p> <p>13 A I believe it was the density or the specific</p> <p>14 gravity of the brine that was recovered from the</p> <p>15 formation by Crossroads when they drilled the well from</p> <p>16 the lower Cockfield.</p> <p>17 Q You said you used that number, if I understood</p> <p>18 correctly, to determine the value 0.43 centipoise. Is</p> <p>19 that true?</p> <p>20 A That is correct.</p> <p>21 Q What means did you employ to make a</p> <p>22 determination of 0.43 centipoise?</p> <p>23 A There is a standard industry nomograph</p> <p>24 presented in various books and papers. The one I use</p> <p>25 was out of Earlougher, which is a -- a correlation of</p>	500	<p>1 A That is correct.</p> <p>2 Q How do you think that happened? It looks like</p> <p>3 the specific gravity they were looking for was the same,</p> <p>4 and assuming they used the industry reference, why do</p> <p>5 you think they come up with a different number?</p> <p>6 A In the TexCom's permit application, that value</p> <p>7 of .5 centipoise for the analysis -- actually,</p> <p>8 Fairchild's analysis, which is included in the TexCom</p> <p>9 application -- is just presented with no back</p> <p>10 calculation as to what the equivalent density or</p> <p>11 specific gravity is.</p> <p>12 I made the assumption that they also used</p> <p>13 1.07 because the only brine or native brine reference in</p> <p>14 the application was to 1.07, so I put down 1.07.</p> <p>15 Whether they rounded that off to .5 versus .43 or what,</p> <p>16 I don't know.</p> <p>17 Q We talked about this a little bit in your</p> <p>18 deposition. We talked about how there is essentially a</p> <p>19 chart --</p> <p>20 A Correct.</p> <p>21 Q -- that one attempts to read to make the</p> <p>22 comparison from specific gravity to viscosity. Correct?</p> <p>23 A At various temperatures, yes.</p> <p>24 Q At various temperatures. I thought I</p> <p>25 remembered your deposition testimony to be that</p>
499	<p>1 density to viscosity at various temperatures.</p> <p>2 Q So it sounds like there are two elements to</p> <p>3 look at in this standard industry reference?</p> <p>4 A Yes.</p> <p>5 Q It would be a density or specific gravity and</p> <p>6 it is a graph against temperature. Is that how it</p> <p>7 works?</p> <p>8 A Yes, I believe it is presented by somebody in</p> <p>9 one of the documents, but I'm not sure who it is. I</p> <p>10 believe it was by TCEQ, actually.</p> <p>11 Q Just glancing -- I will come to this</p> <p>12 individually. It looks like that number varies in the</p> <p>13 analyses that are -- the analyses of falloff tests.</p> <p>14 A Yes.</p> <p>15 Q In the second entry, which I believe is</p> <p>16 Mr. Casey are ALL Consulting analyses, that value varies</p> <p>17 to 1.26 centipoise. Correct?</p> <p>18 A That is correct.</p> <p>19 Q But there is also different specific gravity</p> <p>20 consideration there?</p> <p>21 A Yes.</p> <p>22 Q And then down at the bottom, there is somebody</p> <p>23 named Fairchild that did an analysis and used a</p> <p>24 different value as it pertains to viscosity of 0.5</p> <p>25 centipoise. Do you see that?</p>	501	<p>1 different experts in the field could make different</p> <p>2 evaluations from that chart as to viscosity.</p> <p>3 Did I misunderstood your testimony in the</p> <p>4 deposition?</p> <p>5 A No.</p> <p>6 Q So it's not a matter of right or wrong here,</p> <p>7 it's one expert may have looked at the chart and came up</p> <p>8 with .5, and another expert might have looked at the</p> <p>9 chart and came up with .43. Is that fair?</p> <p>10 A It's possible that they didn't even use that</p> <p>11 chart but used some other methodology.</p> <p>12 Q Would that make the analysis wrong? Would that</p> <p>13 make Fairchild's analysis wrong?</p> <p>14 A Not necessarily.</p> <p>15 Q The EPA even uses a different number, doesn't</p> <p>16 it, in its report for viscosity?</p> <p>17 Take your time if you need to find it.</p> <p>18 A Yeah, they use .364.</p> <p>19 JUDGE EGAN: Where did you find that?</p> <p>20 WITNESS GRANT: On the following page of</p> <p>21 my Exhibit 26.</p> <p>22 JUDGE EGAN: Thank you.</p> <p>23 Q (BY MR. RILEY) So that would be the seventh</p> <p>24 page in. Is that right?</p> <p>25 A They are not numbered, so I'm thinking it's the</p>

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502	<p>1 seventh.</p> <p>2 Q Well, we counted up to six. I'm just looking</p> <p>3 for the number. .364 I find in -- I believe it's the</p> <p>4 seventh page if we counted correctly earlier. Porosity</p> <p>5 has given us 24 percent, and then viscosity, which</p> <p>6 doesn't seem to line up with the word viscosity, but it</p> <p>7 looks like it's .364. Is that right?</p> <p>8 A Yes, I think it lines up with water, but that's</p> <p>9 the first line that's equivalent is the water.</p> <p>10 Q And it does correspond to the other numbers we</p> <p>11 have been discussing that ALL Consulting is 1.26, and</p> <p>12 Crossroads used .5?</p> <p>13 A Correct.</p> <p>14 Q The viscosity number is a factor in calculating</p> <p>15 permeability in the context we have been discussing. Is</p> <p>16 that correct?</p> <p>17 A It's a number in calculating what the falloff</p> <p>18 comes out with, which is transmissibility number, which</p> <p>19 is the millidarcy feet per centipoise; and therefore,</p> <p>20 using -- having the inputs of the centipoise and the</p> <p>21 thickness in feet, the analysis backs out the</p> <p>22 permeability.</p> <p>23 Q So that number 16,523 and your number is</p> <p>24 generated using the viscosity of .43, and then you back</p> <p>25 out I think you said the permeability from that number?</p>	504	<p>1 A That is correct.</p> <p>2 Q The 100-foot number in the Fairchild test, was</p> <p>3 that because at that time 410 was perforated in 100-foot</p> <p>4 interval?</p> <p>5 A Yes.</p> <p>6 Q And the 145 feet is falling the re-perforation.</p> <p>7 Correct?</p> <p>8 A That is correct.</p> <p>9 Q So it does seem, then, that the viscosity</p> <p>10 number, even going from .5 to .43 could be significant</p> <p>11 in terms of generating a different number for</p> <p>12 permeability in this analysis?</p> <p>13 A It's about a 15 percent difference between .5</p> <p>14 and .43. I believe we have talked about that in the</p> <p>15 deposition.</p> <p>16 Q Would it correlate directly, then, to a 15</p> <p>17 percent difference in permeability?</p> <p>18 A No.</p> <p>19 Q It would not?</p> <p>20 A It does not. Correct.</p> <p>21 Q But given what we have just discussed, the</p> <p>22 factor in calculating permeability seems to be -- seems</p> <p>23 to heavily depend on the viscosity one chooses in</p> <p>24 calculating the permeability number?</p> <p>25 A That is right as well as the thickness value.</p>
503	<p>1 A Yes. The software -- the model does that --</p> <p>2 the software -- the analysis software.</p> <p>3 Q Would the inputs to that software be different</p> <p>4 from the 145 feet and the viscosity number?</p> <p>5 A I don't understand what you said.</p> <p>6 Q I am looking at the units for transmissibility.</p> <p>7 It looks like I got feet at 145 feet, I got centipoise</p> <p>8 at .43, and all I am looking -- all I need, then, is the</p> <p>9 solve for millidarcy. Is that correct?</p> <p>10 A That's correct.</p> <p>11 Q So those would be the two inputs?</p> <p>12 A Well, the actual data, obviously, the raw</p> <p>13 data -- the pressure data is the major input.</p> <p>14 Q That shouldn't vary. Right? It should be the</p> <p>15 same pressure data used by everyone?</p> <p>16 A Yes, sir.</p> <p>17 Q So that's from the falloff test?</p> <p>18 A Yes, from this 2009 falloff test.</p> <p>19 Q So there is not a variable there. That's not</p> <p>20 something we would expect a difference in. Is that</p> <p>21 correct?</p> <p>22 A No.</p> <p>23 Q Bad question.</p> <p>24 We would not expect a difference there.</p> <p>25 Is that correct?</p>	505	<p>1 Q Let's look at the second entry here, then,</p> <p>2 which is the 2009 ALL analysis, and I am comparing it to</p> <p>3 the numbers just above.</p> <p>4 First of all, there is a difference in the</p> <p>5 specific gravity. Do you see that there?</p> <p>6 A Yes, I see that.</p> <p>7 Q Do you know why there is a difference in the</p> <p>8 specific gravity?</p> <p>9 A I believe the ALL analysis employs a specific</p> <p>10 gravity and equivalent viscosity of the injectate they</p> <p>11 used for the test.</p> <p>12 Q So that's one difference, but that would then</p> <p>13 lead -- that specific gravity would lead to a difference</p> <p>14 in viscosity read from the -- assuming they used that</p> <p>15 methodology -- read from the standard industry chart.</p> <p>16 Is that how you would explain the</p> <p>17 difference in viscosity?</p> <p>18 A Yes, I believe that would be the case.</p> <p>19 Q The 145-foot value seems to be the same in both</p> <p>20 analyses. Is that correct?</p> <p>21 A Yes, that is correct.</p> <p>22 Q Assuming the pressure data input to be the</p> <p>23 same, it does seem, then, that the difference between</p> <p>24 the value you arrived at for permeability and the value</p> <p>25 ALL Consulting arrived at for permeability, the</p>

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506	<p>1 difference lies in the viscosity.</p> <p>2 Would you agree with me?</p> <p>3 A Yes, that's essentially the case.</p> <p>4 Q And then that viscosity ties back, then, to the</p> <p>5 specific gravity one uses?</p> <p>6 A Correct.</p> <p>7 MR. RILEY: Do you want to take a break?</p> <p>8 JUDGE EGAN: I was going to wait until you</p> <p>9 finished with this, but. . .</p> <p>10 MR. RILEY: I am going to shift gears, so</p> <p>11 I thought it might be a good time.</p> <p>12 JUDGE EGAN: At 3:20 we will be back.</p> <p>13 (Recess: 3:00 p.m. to 3:24 p.m.)</p> <p>14 JUDGE EGAN: You may proceed.</p> <p>15 I'll remind you, Mr. Grant, you are still</p> <p>16 under oath.</p> <p>17 Mr. Riley.</p> <p>18 MR. RILEY: Thank you, Your Honor.</p> <p>19 Q (BY MR. RILEY) Mr. Grant, we broke a moment</p> <p>20 ago, and I would like to turn back to TexCom Exhibit 97,</p> <p>21 your notes, and look at the discussion of modeling or</p> <p>22 your references to various modeling runs.</p> <p>23 Let me see if I am following your notes.</p> <p>24 The third entry, which should be marked model on the</p> <p>25 record copy entitled, "3/09, all pressure model using</p>	508	<p>1 A Yes, I was attempting to limit as little as</p> <p>2 possible the input parameter changes and the pressure</p> <p>3 model from the 2005 TexCom model and used the .84</p> <p>4 centipoise.</p> <p>5 Q This is the modeling you prepared and testified</p> <p>6 about in the last hearing. Correct? It's the 11/07 TDI</p> <p>7 pressure model -- that's the November '07 pressure</p> <p>8 model. Is that correct?</p> <p>9 A I believe that is the case.</p> <p>10 Q So this was not modeling that you did in</p> <p>11 preparation for this rehearing. This was modeling you</p> <p>12 did originally. Correct?</p> <p>13 A I'm not exactly sure what you mean by that.</p> <p>14 Q Well, there was a hearing, as I recall, in</p> <p>15 December of 2007 which you participated.</p> <p>16 A Right.</p> <p>17 Q Which is, based on my general knowledge of the</p> <p>18 calendar, this modeling was done a month before that</p> <p>19 hearing in December 2007?</p> <p>20 A Yes, I believe that is correct.</p> <p>21 Q I believe, if my memory isn't totally gone, you</p> <p>22 testified about the results of this modeling in that</p> <p>23 prior hearing.</p> <p>24 A That is correct.</p> <p>25 Q And you obviously took care in preparing the</p>
507	<p>1 Bost." Do you see that?</p> <p>2 A Yes, I do.</p> <p>3 Q So you have made some notations there. The</p> <p>4 first one is 80.9 millidarcies. Correct?</p> <p>5 A Correct.</p> <p>6 Q 145 feet, that's the injection interval.</p> <p>7 Again, we see the reference to centipoise. In this</p> <p>8 context, the number is different. So could you tell us</p> <p>9 why the number is different and whether it should be</p> <p>10 different in the context of the modeling?</p> <p>11 A Different from what?</p> <p>12 Q Well, just as a comparison. Just above that is</p> <p>13 All Consulting's analysis of the falloff test, and the</p> <p>14 viscosity number and the falloff test analysis done by</p> <p>15 All is 1.26; yet, in the modeling they did the viscosity</p> <p>16 number is .8 to .85 centipoise.</p> <p>17 A The .8 to .85 initially was presented in the</p> <p>18 Bost model in 2005 by ALL Consulting and was carried</p> <p>19 over to their 2009 pressure model. I believe that the</p> <p>20 range of .8 to .85 has to do with -- in the input file</p> <p>21 of their Bost model, they varied the viscosity depending</p> <p>22 upon the depth of the strata in the model -- in their</p> <p>23 variable -- in their variable dip model.</p> <p>24 Q In your model, which is the fourth entry down,</p> <p>25 it looks like you used .84 centipoise. Is that correct?</p>	509	<p>1 model that you presented and testified about in the</p> <p>2 December 2007 hearing. Correct?</p> <p>3 A Yes, I attempted to do that.</p> <p>4 Q You seem like a careful fellow. You made sure</p> <p>5 that when you reported modeling results to these</p> <p>6 administrative law judges, and ultimately to the</p> <p>7 commission, that you wanted to report something useful</p> <p>8 to them. Correct?</p> <p>9 A That is correct.</p> <p>10 Q I see specific gravity entry there. Do you see</p> <p>11 the specific gravity entry in your 11/07 model of 1.0?</p> <p>12 A Yes.</p> <p>13 Q That's different from the All model in 2005.</p> <p>14 In other words, to my way of thinking, 1.079 specific</p> <p>15 gravity is different from 1.0. Is that correct?</p> <p>16 A That is correct.</p> <p>17 Q Did you use the same method that you described</p> <p>18 earlier to determine viscosity for your modeling in</p> <p>19 2007? In other words, did you go to the standard</p> <p>20 industry chart, look at 1.0 specific gravity, and find</p> <p>21 .84 centipoise?</p> <p>22 A No, the 1.0 specific gravity value is required</p> <p>23 in the PRESS model and actually has no -- you cannot put</p> <p>24 a different number in the model than 1.0 specific</p> <p>25 gravity.</p>

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510	<p>1 You can vary the viscosity, which is what</p> <p>2 I put in there.</p> <p>3 Q So the discovery then -- what viscosity should</p> <p>4 be reflected in an accurate model for calculating cone</p> <p>5 of influence, in your opinion?</p> <p>6 A The .84 value.</p> <p>7 Q So for modeling purpose, the viscosity is</p> <p>8 correct, then, in your 11/07 model of .84 centipoise?</p> <p>9 A Yes, that is correct.</p> <p>10 Q That is in the range that ALL Consulting used</p> <p>11 in its Bost modeling in both instances, .84 is in the</p> <p>12 range .8 to .85. Correct?</p> <p>13 A Yes, sir.</p> <p>14 Q You don't have any quarrel, then, with the use</p> <p>15 of a range of .8 to .85 centipoise in the Bost model?</p> <p>16 A Not that I can tell from the input file. It</p> <p>17 appeared to be a legitimate value.</p> <p>18 Q So again, we come back to a word we have heard</p> <p>19 many times here "permeability." And in 11/07 or</p> <p>20 November of '07, the permeability number that you</p> <p>21 recommended the commission rely upon or the modeling</p> <p>22 used in this case was 80.9, or in your notes 81</p> <p>23 millidarcies. Correct?</p> <p>24 A Yes, sir.</p> <p>25 Q If I am understanding your notes correctly,</p>	512	<p>1 than 49 and lower than 81. I believe it would be lower</p> <p>2 than 81.</p> <p>3 Q If we wanted to compare apples to apples, so to</p> <p>4 speak, wouldn't it make sense to you, Mr. Grant, to use</p> <p>5 the .5 centipoise number to compare your calculation of</p> <p>6 permeability?</p> <p>7 A It would if we were attempting to use an</p> <p>8 incorrect input parameter. I do not believe .5 is a</p> <p>9 correct value for viscosity.</p> <p>10 Q And you missed that in the first go-around of</p> <p>11 this hearing in December '08 -- December '07. I'm</p> <p>12 sorry. Correct?</p> <p>13 A Yeah, for the falloff test analysis, I assumed</p> <p>14 the .5 was a legitimate value.</p> <p>15 Q Let's get into this legitimate/illigitimate</p> <p>16 discussion, then, because we had some conversation about</p> <p>17 this in your deposition.</p> <p>18 A That is correct.</p> <p>19 Q I thought we agreed it was a matter of</p> <p>20 professional judgment.</p> <p>21 In other words, two clear-thinking,</p> <p>22 qualified geologists trained in this field could look at</p> <p>23 the same chart and reach a different conclusion.</p> <p>24 Do you agree with that?</p> <p>25 A I do agree with that.</p>
511	<p>1 then, it is the September '09 falloff test that has</p> <p>2 caused you to question now the number you recommended be</p> <p>3 used in modeling of 80.9 in November of '07 until you</p> <p>4 reanalyze or analyze the September '09 data. Is that</p> <p>5 correct?</p> <p>6 A That is correct.</p> <p>7 Q Do you know what the value would be in</p> <p>8 millidarcies if you used the .5 centipoise number that</p> <p>9 was used by Fairchild in December 1999?</p> <p>10 A In December of '99?</p> <p>11 Q They used a specific gravity of 1.07, but they</p> <p>12 read off the chart or through whatever mechanism they</p> <p>13 used, they had a .5 centipoise value, or they used a .5</p> <p>14 centipoise value to calculate their permeability of</p> <p>15 80.9.</p> <p>16 A Correct.</p> <p>17 Q And you used .43?</p> <p>18 A That is correct.</p> <p>19 Q If you used .5 in your analysis, what would the</p> <p>20 permeability be?</p> <p>21 A If I used .5 in the 1999 analysis?</p> <p>22 Q No, if you used .5 in the 2009 analysis, or</p> <p>23 analysis of the pressure falloff test, what would the</p> <p>24 permeability be?</p> <p>25 A I do not know exactly, but it would be higher</p>	513	<p>1 Q So it's not a matter of you're right and</p> <p>2 they're wrong, it's a matter of when you're looking at a</p> <p>3 graph, one might read it differently.</p> <p>4 Is that correct?</p> <p>5 A It's possible; however, I believe I read it</p> <p>6 correctly, and that's the reason I used that number.</p> <p>7 Q So, then, the contrary of that would be that</p> <p>8 you believe that Fairchild read it incorrectly?</p> <p>9 A I don't know if they even used a graph, so I'm</p> <p>10 not really sure where the number came from.</p> <p>11 Q Well, that gets to my next line of questions</p> <p>12 because in the passage of time -- I remember, because I</p> <p>13 am getting old now -- that we used to do a lot of work</p> <p>14 that way. Take a ruler and apply it to a piece of paper</p> <p>15 or a graph that we might find in a textbook and try to</p> <p>16 make an evaluation with precision. So we would look at</p> <p>17 a chart, like the one you have drawn on the board there,</p> <p>18 and we try to pick a number out of that chart.</p> <p>19 Is there a more modern method one might</p> <p>20 employ to convert specific gravity to a centipoise value</p> <p>21 in this context?</p> <p>22 A I do not believe so. I believe using that</p> <p>23 nomograph is probably -- still the most reliable</p> <p>24 methodology.</p> <p>25 Q And I was kind of fooling around yesterday, and</p>

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<p style="text-align: right;">514</p> <p>1 I found there is an app for geology -- for New York 2 geology. I couldn't find one for Texas. There is no 3 computerized way to make this evaluation to the best of 4 your knowledge?</p> <p>5 A One could generate a spreadsheet and take the 6 numbers off of the nomograph and do it that way as far 7 as just a simple Excel spreadsheet, but I don't know of 8 any computer methodology where you put would input a 9 temperature and a specific gravity, and then have an 10 output of viscosity at a different -- at whatever 11 equivalent of density that is.</p> <p>12 Q So then, presumably, in 1999 or 11 years ago, 13 that was the methodology that Fairchild used. Is that 14 correct?</p> <p>15 A I don't know. I don't know if he used the 16 nomograph or not.</p> <p>17 Q Tell me all the ways you know of to convert 18 specific gravity to a centipoise value in the context of 19 our discussion.</p> <p>20 A A nomograph is the only way I would do it. It 21 seems to me in --</p> <p>22 Q That's not my question, sir. I apologize. 23 Tell me all the ways you know -- not the 24 way you do it, but all the ways you know of to do it.</p> <p>25 A I believe I have seen tables in various</p>	<p style="text-align: right;">516</p> <p>1 A It was also generated in Earlougher's SPE 2 nomograph, I believe, No. 11 or 17.</p> <p>3 Q Earlougher. What's Earlougher? You have 4 mentioned that a couple of times.</p> <p>5 A Earlougher is a petroleum engineer well 6 referenced and well known. I believe he was a professor 7 who wrote about well test analyses, and he has one of 8 the -- I guess, one of the classic books on well test 9 analyses.</p> <p>10 Q Ms. Mendoza was waving around a textbook 11 somewhere during the proceeding.</p> <p>12 Have you been here the entire proceeding?</p> <p>13 A Yes, I have.</p> <p>14 Q Did you see the textbook that Ms. Mendoza had 15 in her hand yesterday or the day before?</p> <p>16 A I don't believe so.</p> <p>17 Q It was blue. Does that help your recollection?</p> <p>18 A I believe the Earlougher one is gray -- at 19 least the one I have is gray.</p> <p>20 Q So in this Earlougher book -- do you know -- 21 sometimes professors, as I recall, put out various 22 editions of their book.</p> <p>23 Do you know what edition you have?</p> <p>24 A No, I do not.</p> <p>25 Q Do you know what year it was copyrighted?</p>
<p style="text-align: right;">515</p> <p>1 chemical analysis or chemistry handbooks that have 2 viscosity to -- or density to viscosity conversions.</p> <p>3 Q Did you reference any of those textbooks or 4 analyses or any other --</p> <p>5 A No.</p> <p>6 Q -- any other method other than the graph 7 interpretation that you have described?</p> <p>8 A No, those charts are rough in that the interval 9 points on the charts are far apart, so you don't get -- 10 you can't get an exact number based on an exact 11 temperature and density. They are not as exact as the 12 nomograph is what I am trying to say.</p> <p>13 Q Do you have a copy of the nomograph you used in 14 this case?</p> <p>15 A I do not here. I believe there is one included 16 in a document provided, I believe, by TCEQ in one of 17 their prefiled testimonies.</p> <p>18 Q Do these nomographs vary from publication to 19 publication?</p> <p>20 A No, they seem to be the same nomograph as 21 originally presented, I think, in Matthews & Russell.</p> <p>22 Q Is Matthews & Russell the original source of 23 the nomograph that you used?</p> <p>24 A I believe so. I believe it's SPE Monograph 1.</p> <p>25 Q SPE Monograph 1?</p>	<p style="text-align: right;">517</p> <p>1 A I believe it was 1979, but I'm not positive 2 about that.</p> <p>3 Q Let's flip the page, if you don't mind, on the 4 chart next to you. Would you rise once again with your 5 marker -- and I realize you are not going to be able to 6 reproduce exactly -- but can you show me what you mean, 7 when you have been calling something a nomograph, would 8 you draw a nomograph up there?</p> <p>9 A It's just a big chart that has correlations of 10 viscosity to temperature, and across it there are -- 11 goes this way -- various curves for density or percent, 12 NaCl over brine, total dissolved solids over brine, 13 going from 0 percent up to saturated, which I think on a 14 nomograph --</p> <p>15 JUDGE EGAN: I'm having difficulty 16 hearing you. So on the --</p> <p>17 A This is viscosity, and this is increasing 18 temperature. I believe this is decreasing viscosity 19 here.</p> <p>20 Q (BY MR. RILEY) Is that decreasing?</p> <p>21 A Decreasing viscosity, and this is increasing 22 temperature, and this is percent dissolved, NaCl, coming 23 from zero -- in other words, fresh all the way to 24 saturated, and you can take a temperature, correlate it 25 up to what your density or specific gravity is, and then</p>

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518	<p>1 read on over to what your viscosity value is.</p> <p>2 Q So where would the 1.07 come in? That's</p> <p>3 specific gravity. Right?</p> <p>4 A Yes, you would convert that to percent NaCl.</p> <p>5 There is tables to do that.</p> <p>6 Q So you use a table first, right, then go from</p> <p>7 1.07 specific gravity through a table you convert that</p> <p>8 to percent salt?</p> <p>9 A Percent NaCl dissolved, and that would be in</p> <p>10 parts per milliliter.</p> <p>11 Q Are all the salts the same? Does it make a</p> <p>12 difference if it's not NaCl in the formation?</p> <p>13 A It does, but there is only nomographs, that I'm</p> <p>14 familiar with, with sodium chloride solutions in a sense</p> <p>15 that most formation brines are primarily -- primarily</p> <p>16 meaning 90 percent sodium chloride solution, typically.</p> <p>17 People use these charts. The densities of</p> <p>18 the other constituents that would affect the total</p> <p>19 density are not typically great enough unless you had a</p> <p>20 bromine brine or something to where you would need to</p> <p>21 adjust it for a slightly different --</p> <p>22 Q I am not trying to count the lines -- well, I</p> <p>23 guess I am. So you go from 0 percent salt to 100</p> <p>24 percent -- or totally saturated? It's not 100 percent,</p> <p>25 probably. Right?</p>	520	<p>1 Q And the 1.07, then, is that something I</p> <p>2 am going to be able to -- you converted that to a</p> <p>3 percent of salt.</p> <p>4 A Yeah, you can convert that percent from typical</p> <p>5 chemical engineer's tables in Perry's or the CRC.</p> <p>6 Q So what percent salt does 1.07 specific gravity</p> <p>7 relate to?</p> <p>8 A I can't remember. I would have to look back at</p> <p>9 one of the tables.</p> <p>10 Q So you don't have any notes that would tell you</p> <p>11 what percent you relied upon?</p> <p>12 A No, I typically read it off of one of the</p> <p>13 tables.</p> <p>14 Q So I can work backwards, though -- I could work</p> <p>15 from -- I could go from your centipoise value on that</p> <p>16 nomograph and find a temperature. Right?</p> <p>17 A Find equivalent --</p> <p>18 Q That would lead me to the salt percentage that</p> <p>19 you contemplated when you looked at this?</p> <p>20 A Yes. Right.</p> <p>21 Q So I need to know temperature, then. Right?</p> <p>22 A Yes. And the temperature input was the bottom</p> <p>23 hole temperature of the brine.</p> <p>24 Q What temperature did you use, then?</p> <p>25 A Let me look and see if I have it here.</p>
519	<p>1 A 24 percent, or something in that range.</p> <p>2 Q What increments, then, go from the first -- or</p> <p>3 0 to 24 percent?</p> <p>4 A I think there are increments of 2 percent. I</p> <p>5 haven't drawn all the lines. I think there are</p> <p>6 increments of 2 percent, as best I can recall.</p> <p>7 Q What is the scale in the nomograph you used on</p> <p>8 the Y axis?</p> <p>9 A I believe --</p> <p>10 Q Is it intense --</p> <p>11 A -- it's viscosity units of centipoise.</p> <p>12 Q Yes, sir. And it would be in whole numbers?</p> <p>13 A No, they are broken down into very fine</p> <p>14 numbers, hundredths of a centipoise. It's a pretty</p> <p>15 accurate nomograph. It's more accurate than most of the</p> <p>16 tables, or the one table I have seen out of a chemical</p> <p>17 engineer handbook.</p> <p>18 Q So you can go to 100s of a centipoise. Is that</p> <p>19 what you are saying?</p> <p>20 A I believe so.</p> <p>21 Q I'd certainly find that, since you relied upon</p> <p>22 it, in Erlinger's text. Correct?</p> <p>23 A Right. If I have gone out to .43, it means I</p> <p>24 have determined that the resolution of this is good</p> <p>25 enough to be able to do that.</p>	521	<p>1 Off the top of my head, I am not</p> <p>2 absolutely positive, but I think it was what was used in</p> <p>3 the permit application by TexCom, which I believe was</p> <p>4 148 degrees.</p> <p>5 Q Do you have any reason to vary that</p> <p>6 temperature?</p> <p>7 A I believe I also looked at some of the other</p> <p>8 data that they had gathered from the completion of the</p> <p>9 well and came up with a similar temperature.</p> <p>10 Q So I am asking you as precisely as I can, what</p> <p>11 temperature did you use when you made your reading from</p> <p>12 the nomograph you have described?</p> <p>13 A As best of my recollection, it was 148 degrees.</p> <p>14 Q So going back one more time to the -- you have</p> <p>15 no reason to differ, if that is the right temperature</p> <p>16 represented in the application of the bottom hole</p> <p>17 temperature. Right? That's what we are looking for?</p> <p>18 A Correct.</p> <p>19 Q That's the right temperature, then I should be</p> <p>20 able to -- knowing what you chose for your viscosity</p> <p>21 value and the temperature that we just talked about -- I</p> <p>22 should be able to find the percent salt from the</p> <p>23 nomograph. Correct?</p> <p>24 A That's correct.</p> <p>25 Q That should correlate to a specific gravity of</p>

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522	<p>1 1.07. Correct?</p> <p>2 A Yes.</p> <p>3 Q Okay. So Fairchild got it wrong in your</p> <p>4 opinion. Correct? However, they did it, they have the</p> <p>5 wrong value?</p> <p>6 A I believe that -- I believe they thought it was</p> <p>7 the right value, but I do not believe that is the</p> <p>8 correct value.</p> <p>9 Q I am always fuzzy on this right/wrong thing.</p> <p>10 You said you were correct, which would make everyone</p> <p>11 else who differed from you incorrect. Is that your</p> <p>12 testimony?</p> <p>13 A Based on the original brine analysis, yes.</p> <p>14 Q I don't know of any other basis. So with that</p> <p>15 qualification, you're correct and everyone else is</p> <p>16 incorrect. Is that right?</p> <p>17 A Who do you mean "everyone else"?</p> <p>18 Q Anyone else who had a different number than .43</p> <p>19 centipoise?</p> <p>20 A For the native brine viscosity of bottom hole</p> <p>21 temperature, yes.</p> <p>22 Q Which as we talked about at the outset,</p> <p>23 directly relates to your calculation of permeability of</p> <p>24 48.6 centipoise. Correct?</p> <p>25 A That is correct.</p>	524	<p>1 evaluation of permeability. Is that true?</p> <p>2 A That is my belief.</p> <p>3 Q We talked at some length about reading from a</p> <p>4 nomograph in your deposition. I am going to read you a</p> <p>5 series of questions and answers and see if that's still</p> <p>6 your testimony as it was on March 19 of this year.</p> <p>7 I am reading from Page 166 of the</p> <p>8 deposition of Philip Grant, Line 10. Did they use --</p> <p>9 Line 6, I apologize.</p> <p>10 QUESTION: "Is it your testimony that</p> <p>11 the -- who was it -- Fairchild that did" --</p> <p>12 ANSWER: "Fairchild was the analyst. It</p> <p>13 was for the Crossroads application."</p> <p>14 QUESTION: "Did they use the incorrect</p> <p>15 viscosity as well?"</p> <p>16 ANSWER: "I think they did because it was</p> <p>17 slightly higher, .5. Now based upon their averaging,</p> <p>18 they may have rounded off to .5."</p> <p>19 QUESTION: "Okay. Can you say that that</p> <p>20 was definitely incorrect, or is it better -- or is it</p> <p>21 better professional judgment? What is your answer?"</p> <p>22 ANSWER: "I think it's a matter of</p> <p>23 professional judgment on that, but with different inputs</p> <p>24 of viscosity, the slopes are going to look slightly</p> <p>25 different, plus this latest falloff test, the other</p>
523	<p>1 Q So you have got the right permeability, too.</p> <p>2 That's the right number. Correct?</p> <p>3 A I believe so.</p> <p>4 Q So EPA is wrong on the centipoise issue?</p> <p>5 A EPA calculated their viscosity value based on a</p> <p>6 published -- according to their email or attached</p> <p>7 notes -- a published specific gravity of Conroe oil</p> <p>8 field brines, which are different from what was</p> <p>9 recovered in the TexCom well.</p> <p>10 Q So their number is wrong?</p> <p>11 A Their number is not correct. Yes, it is wrong.</p> <p>12 Q Do you see a difference between the use of the</p> <p>13 word wrong and not correct?</p> <p>14 A No.</p> <p>15 Q So let's go with wrong. EPA is wrong.</p> <p>16 Correct?</p> <p>17 MR. HILL: Your Honor, I am going to</p> <p>18 object. The witness has the right to provide his own</p> <p>19 testimony, and I believe he is doing that.</p> <p>20 JUDGE EGAN: Re-ask your question. And if</p> <p>21 you are comfortable with the way he is phrasing it,</p> <p>22 fine. If not, then state you are not comfortable with</p> <p>23 it. Okay?</p> <p>24 WITNESS GRANT: Yes, ma'am.</p> <p>25 Q (BY MR. RILEY) The EPA is incorrect in its</p>	525	<p>1 difference is the latest falloff test was perforated on</p> <p>2 145 feet versus that one was perforated on 100 feet."</p> <p>3 Do you remember that question and answer,</p> <p>4 or those questions and answers?</p> <p>5 A Yes, sir.</p> <p>6 Q So I thought -- maybe I am incorrect -- I</p> <p>7 thought you said that the choice of viscosity was a</p> <p>8 matter of professional judgment?</p> <p>9 A Yes, I did say that.</p> <p>10 Q In professional judgment terms, then, is there</p> <p>11 a right and wrong, or is it just a matter of one</p> <p>12 engineer might have a different opinion than another</p> <p>13 engineer?</p> <p>14 A Yeah, different engineers could have different</p> <p>15 opinions; however, I believe that my opinion is correct</p> <p>16 or right as you would prefer to use the terminology.</p> <p>17 Q And it is unwavering. Correct? You are right?</p> <p>18 A I believe I am.</p> <p>19 Q And that's true about the transmissivity of the</p> <p>20 fault. You're right? It's not transmissive?</p> <p>21 A I do not believe it is transmissive.</p> <p>22 Q So you are right? The fault is</p> <p>23 nontransmissive?</p> <p>24 A Is my opinion, it is nontransmissive. I don't</p> <p>25 know how else to phrase it.</p>

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526	<p>1 Q Well, there is -- it can't be both. Right?</p> <p>2 And can't be nontransmissive and transmissive, can it?</p> <p>3 A On different layers of the horizon, different</p> <p>4 depths, it can be. But at one specific point, it cannot</p> <p>5 be both transmissive and nontransmissive.</p> <p>6 Q That's a good lead into the next line of</p> <p>7 questions.</p> <p>8 Let's talk about the fault again --</p> <p>9 4400-foot fault. Correct? That's the fault we are</p> <p>10 discussing.</p> <p>11 A Correct.</p> <p>12 Q In the area I'd like to discuss is the</p> <p>13 transmissivity of the fault from the formation we have</p> <p>14 been referring to as the lower Cockfield into the middle</p> <p>15 Cockfield. Are you with me so far?</p> <p>16 A Are you speaking at the fault 4400 feet to the</p> <p>17 south.</p> <p>18 Q Yes, sir. Are we oriented?</p> <p>19 A Yes, we are.</p> <p>20 Q So let's talk about the distance from the well</p> <p>21 410 to the fault -- the 4400-foot fault.</p> <p>22 Is there transmissivity or communication,</p> <p>23 in your opinion, from the well -- I'm sorry -- from the</p> <p>24 lower Cockfield to middle Cockfield in the distance from</p> <p>25 the wellbore to the fault?</p>	528	<p>1 fault, but then your opinion is that there is not</p> <p>2 horizontal transmissivity beyond the fault. Is that</p> <p>3 correct?</p> <p>4 A There is not horizontal transmissivity across</p> <p>5 the fault.</p> <p>6 Q That's better. Thank you.</p> <p>7 So what's in the lower Cockfield at the</p> <p>8 fault stays in the lower Cockfield, in your opinion.</p> <p>9 Correct?</p> <p>10 A In my opinion, yes.</p> <p>11 Q So let's talk about vertical communication or</p> <p>12 transmissivity in that same distance from the wellbore</p> <p>13 to the fault between the lower and middle Cockfield.</p> <p>14 Do you follow me so far?</p> <p>15 A Yes.</p> <p>16 Q As I recall in the prior case, there is</p> <p>17 approximately a 30-foot shale layer between the lower</p> <p>18 Cockfield and the middle Cockfield in the area I just</p> <p>19 described. Is that right?</p> <p>20 A 30 to 35 feet, yes.</p> <p>21 Q Do you think in that distance from the wellbore</p> <p>22 to the 4400-foot fault, that 30- to 35-foot shale layer</p> <p>23 is sealing? In other words, there is not communication</p> <p>24 between the lower Cockfield and the upper Cockfield?</p> <p>25 A Yes.</p>
527	<p>1 A From the 410 wellbore to the fault --</p> <p>2 Q 4400-foot fault.</p> <p>3 A There is laterally -- I am assuming it's</p> <p>4 laterally transmissive.</p> <p>5 Q So it's laterally transmissive. We have been</p> <p>6 calling that horizontal transmissivity.</p> <p>7 A To the fault?</p> <p>8 Q Yes, sir.</p> <p>9 A At the fault, I believe the fault is laterally</p> <p>10 sealing.</p> <p>11 Q So if I'm following, then, your testimony, as a</p> <p>12 licensed professional geologist in the State of Texas,</p> <p>13 when I use horizontal, can we talk about that in</p> <p>14 transmissivity terms? Is that the same as lateral?</p> <p>15 A Yes.</p> <p>16 Q Let's use horizontal, if that's okay, because I</p> <p>17 think we have been using that term for lateral movement.</p> <p>18 A Okay.</p> <p>19 Q So is there vertical transmissivity from the</p> <p>20 wellbore to the 4400-foot fault, such that there would</p> <p>21 be communication between the lower and middle Cockfield?</p> <p>22 A You said vertical transmissivity.</p> <p>23 Q I did. And I meant to. I am sorry if I</p> <p>24 changed gears on you. But we talked about horizontal,</p> <p>25 and you say there is horizontal transmissivity to the</p>	529	<p>1 Q Sorry. I said upper. I meant middle. Let me</p> <p>2 do it again, so I get it right.</p> <p>3 That the 30- to 35-foot shale layer we</p> <p>4 just discussed between the lower and middle Cockfield is</p> <p>5 sealing in the distance from the 410 well to the</p> <p>6 4400-foot fault. Is that correct?</p> <p>7 A That is my belief.</p> <p>8 Q When I said "sealing," I want to be clear on</p> <p>9 the record. Another word that's been used in this case</p> <p>10 is "communication," meaning that the lower and this</p> <p>11 discussion -- lower and middle Cockfield are -- that</p> <p>12 there is transmissivity in that area between the lower</p> <p>13 and middle Cockfield.</p> <p>14 Do you understand the word</p> <p>15 "communication"?</p> <p>16 A Yes.</p> <p>17 Q So said it differently, or said another way,</p> <p>18 there is not communication, in your opinion, between the</p> <p>19 lower and middle Cockfield in the area we have been</p> <p>20 describing?</p> <p>21 A Not in the short-term human time frame of the</p> <p>22 model or the projected 30 years into the future. Maybe</p> <p>23 in geologic time, we are talking millions of years,</p> <p>24 nothing is truly impermeable.</p> <p>25 But in the time frame of the modeling, I</p>

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530	<p>1 have it modeled as impermeable, yes.</p> <p>2 Q Do you believe that there is a point anywhere</p> <p>3 where -- what we have been referring to as the lower</p> <p>4 Cockfield and the middle Cockfield are in communication?</p> <p>5 A Vertically?</p> <p>6 Q Yes, sir.</p> <p>7 A Not within the area of review that has been</p> <p>8 presented and the logs that I have looked at -- the</p> <p>9 cross sections -- excuse me -- that I have looked at.</p> <p>10 Q How far out would you take your opinion in</p> <p>11 distance?</p> <p>12 A As far as the cross sections have been</p> <p>13 presented go, which is, I believe, three to four miles</p> <p>14 to the south, and potentially four to five miles to the</p> <p>15 north.</p> <p>16 Q You have looked at the well records in this</p> <p>17 case, have you not?</p> <p>18 A Yes, I have.</p> <p>19 Q And we had a long conversation -- actually, it</p> <p>20 wasn't that long. It was a brief conversation about the</p> <p>21 well records within the 2.94 mile radius that ALL</p> <p>22 Consulting identified and put into evidence in this</p> <p>23 case.</p> <p>24 Do you remember that discussion?</p> <p>25 A Yes, I do.</p>	532	<p>1 A No. The Lloyd Gosselink law firm received them</p> <p>2 a few days ago.</p> <p>3 Q Have you had a chance to review those records?</p> <p>4 A I have.</p> <p>5 Q As it pertains to those records, then, have you</p> <p>6 identified any wells of concern -- the same context of</p> <p>7 our discussion that you would like to --</p> <p>8 A Yes, I have identified a few.</p> <p>9 Q Can you tell me what they are?</p> <p>10 A If I could have the --</p> <p>11 Q Sure. Let's get that in front of you. It</p> <p>12 might be up there. It should be TexCom Exhibit 94.</p> <p>13 A The wells that appeared to me to be potential</p> <p>14 endangerment pathways included D-3 and 4.</p> <p>15 Q Hang on. Let me get my notes. D-3 and 4?</p> <p>16 A Yes. And E-1, I believe, 30.</p> <p>17 Q Would that be E-30?</p> <p>18 A E as in Edward, number 37; and there may have</p> <p>19 been one more. I would have to look at this list in a</p> <p>20 little more detail.</p> <p>21 Q Take your time. I would like to get your full</p> <p>22 list.</p> <p>23 A How many is that?</p> <p>24 Q I have -- let me tell you what I have so far.</p> <p>25 I have D-3 and 4 -- so D-3, D-4, E-1, E-30, E-37.</p>
531	<p>1 Q So we are now at 2.94 miles, and if I recall</p> <p>2 accurately, your opinion from the deposition testimony,</p> <p>3 is that you see no issues with the wells identified in</p> <p>4 that radius in the sense of issues -- artificial</p> <p>5 penetrations that would cause endangerment to drinking</p> <p>6 water sources?</p> <p>7 A From injection operations of TexCom.</p> <p>8 Q Yes, sir.</p> <p>9 A That is what I stated.</p> <p>10 Q So of the first set of records -- let's call</p> <p>11 that the first set.</p> <p>12 The first set of records, referring to</p> <p>13 what ALL Consulting introduced -- Mr. Casey introduced</p> <p>14 into evidence in this case -- your opinion is that there</p> <p>15 is no pathway for -- or no well that would cause</p> <p>16 endangerment to drinking water. Is that correct?</p> <p>17 A That is correct.</p> <p>18 Q I don't know if you have had time -- I'm</p> <p>19 guessing that maybe you haven't, or if it has been</p> <p>20 provided to you, but there are some other wells now that</p> <p>21 go out a greater distance from the 2.94 miles.</p> <p>22 Are you aware of that?</p> <p>23 A Based upon the presentation that was made or</p> <p>24 the records that were just submitted, yes.</p> <p>25 Q Just earlier today?</p>	533	<p>1 That's five.</p> <p>2 A It appears that there was another tabulation</p> <p>3 that was made that I looked at several days ago that was</p> <p>4 slightly different than this.</p> <p>5 Q That may be true, but I don't know of another</p> <p>6 one from TexCom.</p> <p>7 A Because it had some notations on it that led me</p> <p>8 to believe that that was also a potential problem well.</p> <p>9 We'll just go with this one since this is all we have.</p> <p>10 Q I really don't know of another table, so I</p> <p>11 can't be helpful in that regard.</p> <p>12 A It seems to me there was six. The sixth one</p> <p>13 might have been D -- as in dog -- 5, or one of the E</p> <p>14 wells. I can't remember.</p> <p>15 MR. RILEY: My eyes aren't what they used</p> <p>16 to be.</p> <p>17 Q (BY MR. RILEY) I think D-1 is the top well.</p> <p>18 Is that correct?</p> <p>19 A D-1?</p> <p>20 Q In the chart I am looking at, which is</p> <p>21 APP 1009902, D-1 is the map reference number at the top</p> <p>22 of that table. Correct?</p> <p>23 A Yeah, there was another table that did not have</p> <p>24 plugging status, but it had other information on it, but</p> <p>25 it's not in here.</p>

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534	<p>1 Q Again, I wish I could help, but I don't have</p> <p>2 that table -- at least, I personally don't know about</p> <p>3 it.</p> <p>4 D-1 looks like it was drilled in the '50s,</p> <p>5 7/19 --</p> <p>6 A I said E-1. D-1 is not an issue.</p> <p>7 Q I'm sorry. D-3. I was trying to go from the</p> <p>8 top. D-3 is an issue. Right? D-3 is an issue?</p> <p>9 A Yes.</p> <p>10 Q Is that because the depth is unknown?</p> <p>11 A Yes, the depth is unknown and the resultant</p> <p>12 plugging status is unknown.</p> <p>13 Q And the next one I have on my list that you</p> <p>14 gave me a moment ago is D-4.</p> <p>15 A Yes, sir.</p> <p>16 Q That's of concern because why?</p> <p>17 A The total depth and the plugging status is</p> <p>18 shown on the table with the plugs, but the records --</p> <p>19 there is no records equivalent to those notations that I</p> <p>20 had with mine -- that was delivered to us.</p> <p>21 Q When you say "us," that you received?</p> <p>22 A Delivered -- excuse me -- or that is included</p> <p>23 in this book.</p> <p>24 Q So if I looked at -- let's look at D-4, then,</p> <p>25 in the book.</p>	536	<p>1 stay on the map and see if we have any clues there.</p> <p>2 A Before we get to E-1, there is -- D-5 -- Dog 5,</p> <p>3 I believe, was the sixth one that I had.</p> <p>4 Q Okay.</p> <p>5 A And that one -- I believe there is just a</p> <p>6 notation about that of the lack of records.</p> <p>7 Q It's another unknown. Right?</p> <p>8 A That is correct.</p> <p>9 Q Can we move to E's now?</p> <p>10 A Yes, sir.</p> <p>11 Q I might have moved too quickly.</p> <p>12 D-5, is there a -- on the map is there an</p> <p>13 indication on the map -- a symbol that corresponds?</p> <p>14 A There is a symbol of canceled abandoned</p> <p>15 location.</p> <p>16 Q So that might not be a concern at all. Would</p> <p>17 you agree?</p> <p>18 A If it was never drilled, it would not be a</p> <p>19 concern.</p> <p>20 Q All right. So let's look at the E's now.</p> <p>21 Working from the table first, E-1 is what</p> <p>22 I have on my list. Correct?</p> <p>23 A Yes, sir.</p> <p>24 Q Looks like total depth, and then in</p> <p>25 parentheses, proposed, and then plugging status it says</p>
535	<p>1 If I am understanding you correctly, I</p> <p>2 shouldn't find any reference to plugging in the records</p> <p>3 under label D-4?</p> <p>4 A That is correct.</p> <p>5 Q I have three pages in my book, so I am not an</p> <p>6 expert at reading these. I'll come back to that later.</p> <p>7 Is there another way to see whether there is plugging</p> <p>8 information from the Railroad Commission?</p> <p>9 A If there were other records -- a plugging</p> <p>10 record, but it would not be typically shown on a map,</p> <p>11 though, that kind of detail.</p> <p>12 Q I am looking at the map that's in front of you</p> <p>13 I hope, also, and it looks like D-4 -- at least, based</p> <p>14 on the key at the bottom of the map, indicates that it</p> <p>15 was a drilled dry hole. Do you see that?</p> <p>16 A Yes.</p> <p>17 Q So based on what we can piece together with</p> <p>18 what we have in front of us, would you agree that D-4 is</p> <p>19 most likely a drilled dry hole?</p> <p>20 A Based upon the map symbol, yes.</p> <p>21 Q I'm sorry. I didn't do this for D-3.</p> <p>22 D-3 also looks like it has the same</p> <p>23 symbol. Correct?</p> <p>24 A Yes, it does.</p> <p>25 Q The next one I have on my list is E-1. Let's</p>	537	<p>1 "unknown."</p> <p>2 A Yes.</p> <p>3 Q Is that the basis of your concern, the plugging</p> <p>4 status is unknown?</p> <p>5 A Yes, sir.</p> <p>6 Q Next one is E-30 -- let's look to the map --</p> <p>7 I'm sorry. I apologize.</p> <p>8 E-1, is there any help from the symbol for</p> <p>9 E-1? I think it's way over on the left-hand side. It</p> <p>10 looks like it has the indication for a dry hole.</p> <p>11 A Yes, sir.</p> <p>12 Q Next one is E-30. The table first, E-30, the</p> <p>13 basis for your concern, then, would be that it's</p> <p>14 unknown -- unknown plugging status, unknown depth?</p> <p>15 A Yes, sir.</p> <p>16 Q Let's find it on the map. It looks like it is</p> <p>17 also on the left-hand side, really kind of all by itself</p> <p>18 down there closer to the fault. Do you see it?</p> <p>19 A Yes, sir.</p> <p>20 Q Do you see the indication "dry hole"?</p> <p>21 A Yes, sir.</p> <p>22 Q Then we have one left which is E-37. Correct?</p> <p>23 A Yes, sir.</p> <p>24 Q That is -- shout it out if you know. Can you</p> <p>25 help me find it on the map?</p>

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538	<p>1 JUDGE EGAN: It's right next to E001. Do</p> <p>2 you want to come get mine and then you can see where it</p> <p>3 is.</p> <p>4 Q (BY MR. RILEY) Let's look at the table. What</p> <p>5 does the table tell us, Mr. Grant?</p> <p>6 A The table says it's unknown.</p> <p>7 Q Unknown depth, unknown plugging status.</p> <p>8 Correct?</p> <p>9 A Correct.</p> <p>10 Q What does the map tell us?</p> <p>11 A It indicates an injection disposal well.</p> <p>12 Q Can you tell what type of injection or disposal</p> <p>13 well would be indicated from this information?</p> <p>14 A Not directly. I would assume if it's filed</p> <p>15 under the Railroad Commission regulations, it would be a</p> <p>16 Class II disposal well.</p> <p>17 Q I think after what's now a couple of years of</p> <p>18 talking about this area, we have agreement among most of</p> <p>19 the parties, and certainly the experts in geology that</p> <p>20 the Jackson shale is a confining layer to the Cockfield</p> <p>21 formation. Is that correct?</p> <p>22 A Yes, sir.</p> <p>23 Q Remind us, again, how thick is the Jackson</p> <p>24 shale in this area?</p> <p>25 A I believe it's approximately 900- to a</p>	540	<p>1 Q I don't think it's specific on the map, but</p> <p>2 there is a radius that -- a distance calculation.</p> <p>3 Correct?</p> <p>4 A Correct.</p> <p>5 Q And since you don't have concerns about other</p> <p>6 wells, at least in your opinion, that would be the new</p> <p>7 distance of no concern -- let's call it.</p> <p>8 A The new distance of no concern?</p> <p>9 Q Well, no concern in the context of we have been</p> <p>10 discussing, which is well artificial penetrations</p> <p>11 through the Jackson shale into the Cockfield formation.</p> <p>12 A Let me rephrase what I think you are saying.</p> <p>13 Q Sure. Help me.</p> <p>14 A You are saying beyond 2.94 miles is the</p> <p>15 beginning now of where I would be looking at wells of</p> <p>16 concern, or I would have problems -- I would have</p> <p>17 problem wells?</p> <p>18 Q Yes, sir.</p> <p>19 A And everything in sight of that radial distance</p> <p>20 from the injection well has already been dealt with?</p> <p>21 Q Yes, sir.</p> <p>22 A Yes.</p> <p>23 Q And I haven't looked since we just had this</p> <p>24 discussion, do you know the distance, then, we can now</p> <p>25 work with beyond 2.94 to the first well of concern that</p>
539	<p>1 1000-feet thick.</p> <p>2 Q So if I am -- if my understanding is correct,</p> <p>3 then, the only means for migration of fluid out of the</p> <p>4 Cockfield formation upwardly or to the surface would be</p> <p>5 through an artificial penetration in this area that we</p> <p>6 have been discussing. Correct?</p> <p>7 A Yes, sir.</p> <p>8 Q That's why we have been concerned with</p> <p>9 artificial penetrations into the Cockfield formation.</p> <p>10 Correct?</p> <p>11 A Correct.</p> <p>12 Q And as I understand your opinion, we are good</p> <p>13 in that regard, altitude .94 miles. Correct?</p> <p>14 A That is correct.</p> <p>15 Q And whatever -- of the wells of concern, from</p> <p>16 the new wells records introduced, we would be good, so</p> <p>17 to speak, out to the distance -- the closest distance</p> <p>18 from the WDW410 to whatever well -- in the six wells you</p> <p>19 have identified of concern -- we would be good out that</p> <p>20 distance, too. Is that correct?</p> <p>21 Let me try that again.</p> <p>22 A Okay.</p> <p>23 Q There is going to be one of those wells that's</p> <p>24 closest to the 410 well?</p> <p>25 A Yes.</p>	541	<p>1 you have just listed?</p> <p>2 A Based upon using a permeability of 48.68?</p> <p>3 Q That's not my question. I know where you</p> <p>4 going, and that's not my question.</p> <p>5 A I'm sorry.</p> <p>6 Q My question is: Based on just distance, do you</p> <p>7 have a new distance calculation for me? Not -- I am</p> <p>8 talking from the wellbore to the first well of concern</p> <p>9 that you have just described.</p> <p>10 A Yeah, that distance would be to D-3.</p> <p>11 Q That's just over the 2.94 mile radius.</p> <p>12 Correct?</p> <p>13 A Yes, sir.</p> <p>14 Q Now, during our deposition and throughout this</p> <p>15 discussion, again, relative to the Jackson shale</p> <p>16 formation, we talked a good deal about natural closure</p> <p>17 of wellbores or artificial penetrations. Do you agree?</p> <p>18 A Yes, sir.</p> <p>19 Q And it is my understanding that your opinion is</p> <p>20 that there would be -- that a wellbore or a well drilled</p> <p>21 through the Jackson shale that was not cased, that that</p> <p>22 wellbore would seal naturally. Is that correct?</p> <p>23 A That is my belief.</p> <p>24 JUDGE WALSTON: May I ask a clarifying</p> <p>25 question on that?</p>

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542	<p>1 WITNESS GRANT: Of course.</p> <p>2 JUDGE WALSTON: We have talked about</p> <p>3 uncased wells would close naturally. What type of wells</p> <p>4 would you expect to be uncased? A dry hole, I assume?</p> <p>5 WITNESS GRANT: Yes, sir.</p> <p>6 JUDGE WALSTON: Any others?</p> <p>7 WITNESS GRANT: A dry hole that did not</p> <p>8 have casing set. Some dry holes they just drill it down</p> <p>9 to total depth, log it -- open hole log it, and then</p> <p>10 plug it without setting casing because they don't want</p> <p>11 to spend the money to set the casing.</p> <p>12 Others are dry holes, but casing is set</p> <p>13 and the formation is tested probably because they had</p> <p>14 some indication of oil and gas, and it either turned out</p> <p>15 to be not in economic quantities producible, or it just</p> <p>16 was what they would say was wet. It didn't have any oil</p> <p>17 and gas and so they at that point plugged it.</p> <p>18 So a dry hole could have casing set</p> <p>19 through the Jackson or not set through the Jackson.</p> <p>20 JUDGE WALSTON: Thank you.</p> <p>21 Q (BY MR. RILEY) If I understand, then -- that</p> <p>22 really was where I was going. The exchange you just had</p> <p>23 with the ALJs is that there are two possibilities,</p> <p>24 basically, when one drills a well.</p> <p>25 The first possibility -- well, maybe</p>	544	<p>1 the heavy mud that you would use and you would lose your</p> <p>2 well and potentially lose all your mud out of the hole,</p> <p>3 and you could potentially have a blowout.</p> <p>4 Q We don't do this every day, or at least I</p> <p>5 should say, I am not familiar with what long string</p> <p>6 casing is. I kind of get the concept.</p> <p>7 Would any artificial penetration in this</p> <p>8 area that proceeded through the Jackson shale be cased</p> <p>9 in the Jackson shale as part of surface casing? In</p> <p>10 other words, the surface casing, would that ever</p> <p>11 contemplate, in your mind, casing in the Jackson</p> <p>12 shale -- surface casing required by the Water Commission</p> <p>13 or TCEQ?</p> <p>14 A I am not sure about that. In the '30s and</p> <p>15 '40s, probably not. In more recent times, the water</p> <p>16 board might require casing to be set into the Jackson</p> <p>17 shale. It would probably depend upon the time frame of</p> <p>18 when the well was drilled.</p> <p>19 Q So the first possibility I tried to describe</p> <p>20 was a well where casing was set -- I'm sorry -- where</p> <p>21 casing was not set, and doing a fantastic job of getting</p> <p>22 there. But, in your opinion, in the time frame for the</p> <p>23 wells of concern, would you have expected casing to be</p> <p>24 set in a dry hole through the Jackson shale formation?</p> <p>25 A I would not expect it, but I would not rule it</p>
543	<p>1 three. First possibility is a dry hole, nothing, no</p> <p>2 production is indicated. Correct?</p> <p>3 A That is a possibility, yes.</p> <p>4 Q Would you expect anyone in their logical</p> <p>5 rational mind so set casing in such a circumstance?</p> <p>6 A It depends when they thought it was -- they</p> <p>7 determined it was nonproductive.</p> <p>8 Q That's what I'm saying. At the outset -- let's</p> <p>9 say they just drill -- they drilled to total depth or</p> <p>10 they drilled to proposed depth, and just bad luck, they</p> <p>11 don't find anything. Nothing even indicating potential</p> <p>12 production.</p> <p>13 A Then they would most likely not set long string</p> <p>14 casing. Surface casing would have been set as required</p> <p>15 by the Texas Water Board. But long string casing, when</p> <p>16 there is no indications of oil and gas, it would be</p> <p>17 unlikely that they would set casing unless they were</p> <p>18 going to a great enough depth that they had to set an</p> <p>19 intermediate string of casing.</p> <p>20 Q Was that for the purposes of continuing</p> <p>21 drilling that there had to be some casing set?</p> <p>22 A Yeah, you would reach a potential pressure</p> <p>23 differential where you couldn't go any deeper without</p> <p>24 setting casing or you would potentially break down your</p> <p>25 formations -- some of your shallower formations due to</p>	545	<p>1 out. It also depends what the total depth of the well</p> <p>2 would be, whether it was going to the Wilcox or just</p> <p>3 through the Cockfield.</p> <p>4 Q What is the depth of the Cockfield formation in</p> <p>5 the area of D003?</p> <p>6 A I believe it's about equal or potentially --</p> <p>7 the depth of the base of it or the top of it?</p> <p>8 Q Let's do both.</p> <p>9 A Assuming the base and the top, the same</p> <p>10 thickness of the Cockfield occurs. I would expect they</p> <p>11 would be potentially even or slightly lower than at the</p> <p>12 TexCom well. However, I don't have the structure map --</p> <p>13 the regional structure map in front of me to absolutely</p> <p>14 confirm that.</p> <p>15 Q Do the rock stratum we are discussing called</p> <p>16 the Cockfield formation, does it travel downward to the</p> <p>17 north, upward to the north, neither? What's the general</p> <p>18 direction in the -- by the way, I am saying to the</p> <p>19 north, but I really mean in the direction of concern,</p> <p>20 let's call it, toward D003?</p> <p>21 A The Cockfield reaches a high or a crest over</p> <p>22 the center of the Conroe dome. As you move north, it</p> <p>23 decreases -- it becomes deeper until it reaches what</p> <p>24 geologists call a withdrawal or assault withdrawal</p> <p>25 syncline out at some distance from the dome, and then</p>

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546	<p>1 starts to rise in the normal climb towards -- away from</p> <p>2 the coast or towards inland.</p> <p>3 Q So if I am following, then, it travels downward</p> <p>4 for some time, and then starts to rise again? Is that</p> <p>5 correct?</p> <p>6 A There is a slight syncline or low around on</p> <p>7 this north side around the edge of the dome before it</p> <p>8 starts to rise again to the north.</p> <p>9 Q And the area we have been discussing, namely</p> <p>10 about three miles to the -- I'll call it northwest.</p> <p>11 Is that a fair characterization?</p> <p>12 A Yes, sir.</p> <p>13 Q About three miles northwest. What would you</p> <p>14 expect the Cockfield formation to be doing?</p> <p>15 A I would think it would be either coming out of</p> <p>16 that syncline or potentially still in it, which is the</p> <p>17 reason that I am saying it is potentially slightly</p> <p>18 deeper or even with the structure at the TexCom well.</p> <p>19 Q Since we are not geologists, and we have</p> <p>20 differences in views of time, for instance, when you say</p> <p>21 "slightly different," can you put that in relative terms</p> <p>22 or something that would be --</p> <p>23 A I was thinking 50 to 100 feet.</p> <p>24 Q How about, more or less, straight to the west?</p> <p>25 Is there any difference in your answer if it is heading</p>	548	<p>1 Q And then to the southwest, dip slightly, but a</p> <p>2 little bit more than the last answer -- about 100 feet.</p> <p>3 Is that your expectation?</p> <p>4 A That would be my expectation.</p> <p>5 MR. RILEY: Can I have just a minute,</p> <p>6 Judge?</p> <p>7 JUDGE EGAN: That's fine.</p> <p>8 Q (BY MR. RILEY) Let's change gears a little</p> <p>9 bit, Mr. Grant.</p> <p>10 Remember from a couple of years ago when</p> <p>11 we first met that you had significant confidence, in my</p> <p>12 opinion, of the TCEQ's Class I well regulatory program.</p> <p>13 Is that a fair statement?</p> <p>14 A Yes, sir.</p> <p>15 Q And that you saw -- although we disagreed as to</p> <p>16 what might be required of an applicant in this case</p> <p>17 because of the 410 being an existing well, I assume you</p> <p>18 agree that an annual falloff test is required if TexCom</p> <p>19 gets this permit. Is that true?</p> <p>20 A That is my belief, yes.</p> <p>21 Q Were you here when I was asking Mr. Casey</p> <p>22 questions about -- not that long ago, sometime this</p> <p>23 afternoon -- about the need for an annual falloff test?</p> <p>24 A Yes, sir.</p> <p>25 Q And have you, in your work, done annual falloff</p>
547	<p>1 straight to the west?</p> <p>2 A It's more likely to be what geologists call a</p> <p>3 long strike or probably have a similar elevation or a</p> <p>4 sub C depth.</p> <p>5 Q You say "similar" again --</p> <p>6 A Similar within -- if you are going straight</p> <p>7 west or if you are paralleling the fault versus going</p> <p>8 straight west?</p> <p>9 Q Go straight west first.</p> <p>10 A I would say it would probably have a similar</p> <p>11 depth.</p> <p>12 Q "Similar" would mean in your mind?</p> <p>13 A Within 50 to 100 feet. Probably within closer</p> <p>14 to 50, but without looking at a regional map, I wouldn't</p> <p>15 be able to tell you.</p> <p>16 Q Let's go now parallel with the fault. What</p> <p>17 would you expect to be occurring?</p> <p>18 A It would probably dip slightly to a greater</p> <p>19 depth. Probably 100 feet.</p> <p>20 Q Okay. So northwest somewhere between 50- to</p> <p>21 100-feet deeper. Is that correct?</p> <p>22 A Yes.</p> <p>23 Q And straight west somewhere between 50- to</p> <p>24 10-feet deeper but closer to 50 feet?</p> <p>25 A Yes, I would say so.</p>	549	<p>1 tests for a client or evaluated annual falloff test data</p> <p>2 for a client?</p> <p>3 A Yes, sir.</p> <p>4 Q And from year to year have you seen variations</p> <p>5 in permeability?</p> <p>6 A Yes, I have.</p> <p>7 Q In those instances, has there ever been a</p> <p>8 variation in permeability when you have been working for</p> <p>9 a Class I well operator, that have caused you to change</p> <p>10 operational parameters?</p> <p>11 A Yes, sir.</p> <p>12 Q So I am going to go ahead and make the leap</p> <p>13 that the variation in permeability that you discovered</p> <p>14 was significant in the context of the regulatory program</p> <p>15 that changes needed to be made to the permit. Is that</p> <p>16 fair?</p> <p>17 A In the cases that I have been involved in, it</p> <p>18 was an operational concern by the client, not a permit</p> <p>19 issue.</p> <p>20 Q I see. So let's just -- in general terms, was</p> <p>21 the permeability found to be greater or lesser in the</p> <p>22 context --</p> <p>23 A It was found to be lesser.</p> <p>24 Q Have you had the other experience where</p> <p>25 permeability varies in an upward direction?</p>

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550	<p>1 A Yes, I have. These are -- can I clarify that?</p> <p>2 Q When I ask you, but let's hold up on that.</p> <p>3 A Okay.</p> <p>4 Q What I am trying to get at -- and it is a</p> <p>5 conversation you and I had, I think, in your</p> <p>6 deposition -- is that in real world terms permeability</p> <p>7 of rock stratum doesn't change.</p> <p>8 Is that a fair statement?</p> <p>9 A That is my belief, yes.</p> <p>10 Q But given the imperfect world we live in, the</p> <p>11 measurement or the evaluation of permeability with the</p> <p>12 tools we have available in falloff testing, can yield</p> <p>13 different results. Is that correct?</p> <p>14 A I guess I would say "yes" with a qualification.</p> <p>15 Q Please do.</p> <p>16 A If the parameters of the flow profile or the</p> <p>17 pressure regime in the well changes, that permeability</p> <p>18 is likely to change. If nothing changes in the flow</p> <p>19 profile, meaning thickness, nothing changes in the</p> <p>20 percentage going into various sands, the permeability is</p> <p>21 likely to stay like we had mentioned before, within 5</p> <p>22 millidarcies from year to year.</p> <p>23 What causes the yearly changes in average</p> <p>24 permeability over the receiving interval is -- typically</p> <p>25 changes in that receiving interval, either pressure</p>	552	<p>1 A Typically in an injection well, it would be the</p> <p>2 pressure put into the wellbore through injection of high</p> <p>3 volumes of fluid to reach a high enough pressure in your</p> <p>4 strata across from your perforations to fracture the</p> <p>5 rock to allow, typically, vertical fractures to form</p> <p>6 adjacent to and out some distance from the perforations.</p> <p>7 That pressure at which that begins to</p> <p>8 occur is generically called a frac pressure. There is</p> <p>9 multiple versions of frac pressure. There is initial</p> <p>10 frac pressure, there is extension pressure, closure</p> <p>11 pressure, but they are all related to fracture.</p> <p>12 Q How does one calculate a frac pressure for a</p> <p>13 particular formation?</p> <p>14 A One has to know the overburdened gradient and</p> <p>15 the gradient of the reservoir. I don't want to say</p> <p>16 brine gradient, but the pressure gradient within the</p> <p>17 reservoir. Those numbers you can calculate a frac</p> <p>18 gradient.</p> <p>19 Q Is there a frac pressure relevant to this --</p> <p>20 the discussion of this application? If so, do you know</p> <p>21 what it is?</p> <p>22 A I believe there is one calculated in the</p> <p>23 application.</p> <p>24 Q Do you know what it is?</p> <p>25 A No, not off the top of. No.</p>
551	<p>1 regime changes or thickness regime -- thickness changes.</p> <p>2 Q So this whole notion of -- we perforate in an</p> <p>3 interval in the context of our discussion. Right? One</p> <p>4 of the things to consider is the perforated interval.</p> <p>5 Is that fair?</p> <p>6 A Yes, sir.</p> <p>7 Q If those perforations don't change, can the</p> <p>8 permeability change?</p> <p>9 A I believe it can. The average permeability is</p> <p>10 determined from the falloff test can change if the</p> <p>11 percentages of flow going into the various sands change.</p> <p>12 In other words, a high permeability sand, which the</p> <p>13 previous year took, a majority of the flow now takes a</p> <p>14 much smaller amount because it has been pressured up and</p> <p>15 some of that flow is diverted into other sands, which</p> <p>16 were taking flow before but not as high a rate.</p> <p>17 That can change your average calculated</p> <p>18 permeability of the reservoir, but those individual sand</p> <p>19 permeabilities don't change. What does change is that</p> <p>20 average. And that average is probably more truly called</p> <p>21 the transmissibility, which is the product of all three</p> <p>22 of those.</p> <p>23 Q I have been struggling with the term "frac</p> <p>24 pressure." I am trying to understand it.</p> <p>25 Could you explain what frac pressure is?</p>	553	<p>1 Q The phenomenon you were describing a moment ago</p> <p>2 about changes that might occur in permeability analysis</p> <p>3 following a falloff test, is that related to frac</p> <p>4 pressure, or is that a different kind of phenomenon?</p> <p>5 A That's kind of a different phenomenon. They</p> <p>6 are all related to pressuring up the reservoir, but it's</p> <p>7 not quite the same thing.</p> <p>8 Q Did you hear in Casey's testimony when he said</p> <p>9 that generally, or as a rule of thumb, one would expect</p> <p>10 vertical transmissivity -- permeability -- sorry --</p> <p>11 vertical permeability to be about ten times less than</p> <p>12 horizontal permeability? Did you hear that testimony?</p> <p>13 A Yes, I did.</p> <p>14 Q Do you agree with that?</p> <p>15 A Yes, I do. Excuse me.</p> <p>16 In a totally homogeneous sand, it would be</p> <p>17 the same. But most sands are stratified to some effect.</p> <p>18 And not just talking about between sand and shale, but</p> <p>19 in a sand itself, there is typically small</p> <p>20 stratifications -- horizontal stratifications, which</p> <p>21 reduce the vertical permeability of that sand package.</p> <p>22 Q So in the lower Cockfield -- let's talk about</p> <p>23 that first.</p> <p>24 Below the 30- to 35-foot shale layer,</p> <p>25 would you expect vertical permeability to be about 10</p>

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554	<p>1 times less than horizontal permeability?</p> <p>2 A In which of the sands?</p> <p>3 Q In the lower Cockfield.</p> <p>4 A In any of the sands?</p> <p>5 Q Hopefully, it makes sense to ask about the area</p> <p>6 around WDW410.</p> <p>7 A Around WDW410, there is approximately 145 feet</p> <p>8 of sand -- net sand in that 345 feet, I believe it is,</p> <p>9 of the lower Cockfield. And each one of those</p> <p>10 individual sands is slightly -- it was deposited in a</p> <p>11 slightly different depositional environment.</p> <p>12 So the stratification can be slightly</p> <p>13 different. So the actual ratio of horizontal to</p> <p>14 vertical permeability is going to vary in each one of</p> <p>15 those. But if you were to take an average of a slightly</p> <p>16 shaley sand of which most of the lower Cockfield sands</p> <p>17 are not true clean, blocky, totally clean sands, I would</p> <p>18 probably say that there is -- the ratio was probably</p> <p>19 close to 10 to 1, maybe as clean as 5 to 1.</p> <p>20 Q I think Mr. Casey testified -- I believe you</p> <p>21 were present -- about the production -- production in</p> <p>22 the Conroe field actually occurring from different</p> <p>23 layers, as I think of it, in the upper Cockfield,</p> <p>24 generally speaking.</p> <p>25 Do you recall that testimony?</p>	556	<p>1 on what we just discussed about where the productive</p> <p>2 layers are?</p> <p>3 A Well, from what I have read, the permeability</p> <p>4 of the middle is typically greater than the lower, and</p> <p>5 the permeability of the upper Cockfield is even greater</p> <p>6 than that of the middle. So my guess would be that the</p> <p>7 stratification is less in the upper Cockfield -- at</p> <p>8 least in the upper Cockfield, and the cleanliness or the</p> <p>9 lack of shale would be least in the upper Cockfield.</p> <p>10 Q Yet there still is different -- there are still</p> <p>11 different sands in the upper Cockfield that are found to</p> <p>12 be productive?</p> <p>13 A Yes. There is shale there that is</p> <p>14 intervening -- not intermingled, but layered in between</p> <p>15 the various upper Cockfield sands.</p> <p>16 Q I think -- tell me if I am wrong. In general</p> <p>17 terms of principle of producing oil and gas from</p> <p>18 underground is that oil gas are lighter than water and</p> <p>19 come to the top of the formation?</p> <p>20 A In a trap, yes.</p> <p>21 Q They must be trapped. Correct? Because if</p> <p>22 they kept coming, they would have been gone a long time</p> <p>23 ago. Is that right?</p> <p>24 A Yeah, they are trapped below the Jackson.</p> <p>25 Q And then below that in various layers. Is that</p>
555	<p>1 A Yes, sir.</p> <p>2 Q And it sounds like there might be some</p> <p>3 stratification going on in that regard as well. Would</p> <p>4 you agree with that?</p> <p>5 A Yeah, I believe there is, at least, six</p> <p>6 different main Conroe sands that are productive, and</p> <p>7 those don't include the two minor sands above that,</p> <p>8 which have a slightly different name -- Cockfield stray</p> <p>9 or something like that.</p> <p>10 Q So this is all -- we are all talking about this</p> <p>11 in the context of the upper Cockfield formation.</p> <p>12 Correct?</p> <p>13 A Upper, and apparently there is some small</p> <p>14 amount of production at the top of the middle Cockfield.</p> <p>15 Q Have you been involved in any enhanced oil</p> <p>16 recovery operations in your professional work?</p> <p>17 A No, sir.</p> <p>18 Q In the context of our discussion a moment ago,</p> <p>19 then, is it reasonable to conclude there is not -- the</p> <p>20 word you used and it appeals to me is the sands are not</p> <p>21 clean. And I took that to mean that there is</p> <p>22 stratification in the sands and there might be a lack of</p> <p>23 vertical transmissivity in the context of our --</p> <p>24 A In lower Cockfield, yes.</p> <p>25 Q Is the same true in the upper Cockfield based</p>	557	<p>1 true?</p> <p>2 A Yes, sir.</p> <p>3 Q So in the upper Cockfield in these various</p> <p>4 layers we have just been discussing, there are traps or</p> <p>5 barriers for oil and gas to rise to the top of even the</p> <p>6 Cockfield formation?</p> <p>7 A I haven't studied the upper Cockfield</p> <p>8 production, other than having read some of the</p> <p>9 unitization hearing and read book reports.</p> <p>10 Whether there is intervening water zones</p> <p>11 between the gas, oil, and underlining water, I am not</p> <p>12 positive about that because I didn't really study that.</p> <p>13 Q You mentioned a moment ago that you had some</p> <p>14 awareness of a great permeability in the middle</p> <p>15 Cockfield. Let's start with, greater than what?</p> <p>16 A It seems to me some of the documents that I</p> <p>17 read indicated permeabilities in the 200 millidarcy</p> <p>18 range.</p> <p>19 Q 200 millidarcy?</p> <p>20 A Yes, sir.</p> <p>21 Q That's for the middle?</p> <p>22 A Yes, sir.</p> <p>23 Q How about the upper?</p> <p>24 A The upper, as I recall, the ranges were from</p> <p>25 500 to 800 to potentially one darcy in permeability.</p>

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<p style="text-align: right;">558</p> <p>1 Q Is this whole darcy thing linear? In other</p> <p>2 words, let's pick some values, and I'll try to frame a</p> <p>3 question.</p> <p>4 If I have a permeability of 80</p> <p>5 millidarcies. Okay so far?</p> <p>6 A Uh-huh.</p> <p>7 Q Is it -- then I look at a permeability of 150</p> <p>8 millidarcies. Okay? I am trying to come up with values</p> <p>9 and I am sorry that I did this in an awkward way.</p> <p>10 But let's take the values at 50</p> <p>11 millidarcies, 80 millidarcies, and 150 millidarcies.</p> <p>12 Okay?</p> <p>13 A Okay.</p> <p>14 Q The difference in millidarcies between 50 and</p> <p>15 80 is 30. Correct?</p> <p>16 A Yes.</p> <p>17 Q And the difference in millidarcies between 80</p> <p>18 and 150 is 70. Correct?</p> <p>19 A Yes, sir.</p> <p>20 Q Does that mean that there is a linear</p> <p>21 relationship between pressure buildup and the millidarcy</p> <p>22 or the permeability number? In other words, would I</p> <p>23 expect -- if I am trying to inject into a 50 millidarcy</p> <p>24 sand, and I find a 80 millidarcy sand, what I am trying</p> <p>25 to say, does the pressure build up in the same fashion?</p>	<p style="text-align: right;">560</p> <p>1 millidarcy permeability. So I am just spacing it by 30</p> <p>2 millidarcies.</p> <p>3 A Okay.</p> <p>4 Q Then I am imagining an evaluation of pressure</p> <p>5 build up with rock formation or rock stratum that have</p> <p>6 those values. What I am trying to understand is what I</p> <p>7 expected to move in the same way as the permeability</p> <p>8 number does.</p> <p>9 I think you are on the right track what I</p> <p>10 am trying to get at, but I don't know if I have been</p> <p>11 helpful to you.</p> <p>12 A I think without -- if you kept all the other</p> <p>13 input parameters the same and just changed the</p> <p>14 permeability value, say, in the PRESS model, would it</p> <p>15 linearly increase the pressure at some observation</p> <p>16 point?</p> <p>17 Q Yes, sir.</p> <p>18 A Between -- for each 30 you would get a linear</p> <p>19 change in pressure.</p> <p>20 Q Again, I'm --</p> <p>21 A I can't answer that without running because I'm</p> <p>22 not positive about that.</p> <p>23 Q Let me do one more number set because I have</p> <p>24 made yet another error. Let's go with 40, 80 and 120.</p> <p>25 A All right.</p>
<p style="text-align: right;">559</p> <p>1 Does that make sense to you what I am</p> <p>2 trying to get at?</p> <p>3 A You mean the rate of pressure build up?</p> <p>4 Q Yes, sir. That might be the way I'm looking at</p> <p>5 it.</p> <p>6 I think I can do a better job with the</p> <p>7 numbers.</p> <p>8 A I am just thinking of the equation that's used</p> <p>9 and where those sit and the other input parameters and</p> <p>10 how that affects it.</p> <p>11 Q Why don't you think about that one a little bit</p> <p>12 more. It's looks like we might be close to a break for</p> <p>13 the day.</p> <p>14 Let me go onto another thing, but if you</p> <p>15 want to, by no means can I ask you to or command you to.</p> <p>16 A I was thinking, the only way to really define</p> <p>17 it would be to run the calculation because I'm not</p> <p>18 positive if it's linear or not. That would be my</p> <p>19 answer.</p> <p>20 Q And that's fine. And what I am looking for is</p> <p>21 when we look at numbers, as lawyers, sometimes we make</p> <p>22 relationships that don't exist. For instance, if I were</p> <p>23 to look -- I picked bad numbers, but let me pick,</p> <p>24 hopefully, better numbers. A 50 millidarcy</p> <p>25 permeability, an 80 millidarcy permeability, and a 110</p>	<p style="text-align: right;">561</p> <p>1 Q Now they are -- half of 80 is 40. Right?</p> <p>2 Could I expect or should I expect pressure build up to</p> <p>3 be twice as great? Do you follow me?</p> <p>4 A Between 40 and 80?</p> <p>5 Q Yes, sir.</p> <p>6 A No, I don't believe that would be the case.</p> <p>7 It's not obvious between changing from 80 to 40</p> <p>8 millidarcies, as far as doubling the pressure out at</p> <p>9 some distance between two model runs. I mean, that's</p> <p>10 the closest I can get. It's not exactly 40 and 50, but</p> <p>11 not -- 49 or whatever, but it did not double the</p> <p>12 pressure increase out at an observation point out there.</p> <p>13 Q I think that's as close as I'm going to push</p> <p>14 you this evening.</p> <p>15 A That's fine. We can keep going.</p> <p>16 Q Let me see if I have another topic that's</p> <p>17 short.</p> <p>18 A I'm good until 10:00 tonight if you need me to</p> <p>19 be.</p> <p>20 JUDGE EGAN: Are you at a stopping place</p> <p>21 because we need to work out some of the witnesses for</p> <p>22 tomorrow.</p> <p>23 MR. RILEY: I am.</p> <p>24 JUDGE EGAN: We need to figure out what we</p> <p>25 need to do tomorrow. Does anybody have a problem with</p>

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1 stopping right now?

2 It looks like everybody is in agreement.

3 It's been a long day.

4 You are excused from the witness seat

5 until tomorrow morning.

6 WITNESS GRANT: What time, Your Honor?

7 JUDGE EGAN: Well, maybe tomorrow morning,

8 depending on -- we have got some witnesses, I gather,

9 that are going to be coming in. So your attorney

10 will -- Mr. Hill will let you know what time to be here.

11 We start at 9:00, but I don't know what time he will

12 want you here.

13 MR. RILEY: I just want to point out that

14 I know there is a lot of people traveling in from out of

15 town. I am not opposed, if anyone is interested in

16 knowing my position, that if we want to resume with

17 Mr. Grant at some other point, even next week, if

18 somehow that aids in getting witnesses in and out --

19 JUDGE WALSTON: Why don't we go off the

20 record.

21 (Proceedings recessed at 4:50 p.m.)

22

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